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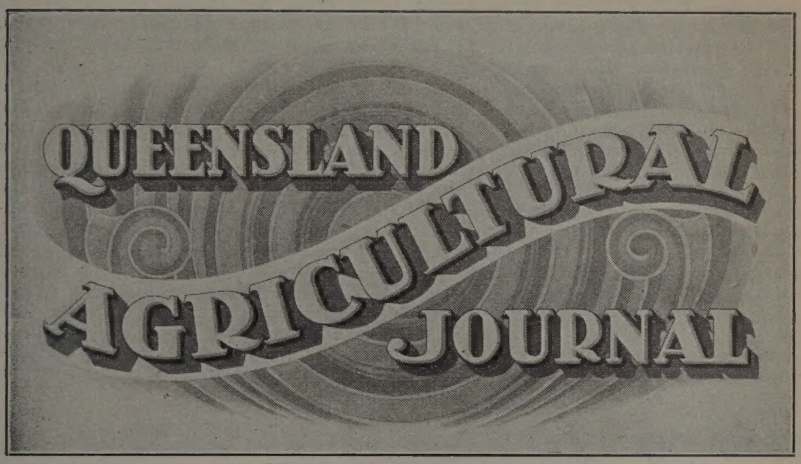

VOL. XL. 1 NOVEMBER, 1933. PART 5.

Event and Comment.

Stabilisation of the Dairy Industry.

FROM the farmer's point of view, one of the most important measures submitted to Parliament this session is the Dairy Products Stabilisation Bill, introduced by the Minister for Agriculture and Stock (Hon. Frank W. Bulcock) on 27th October. A similar measure has been presented to the Victorian Parliament, and the New South Wales Government is contemplating similar action. The new legislation is the outcome of certain decisions of the last interstate conference of Secretaries for Agriculture. At that conference one of the major matters discussed was the effect of what is known as the "Peanut Judgment" on interstate operations of primary producers' marketing organisations. It will be remembered that a High Court judgment was given some little time ago on an appeal from the Queensland courts in respect of the marketing operations of the Peanut Pool. That judgment defined the sphere of State practice, and mentioned specifically that States are bound by section 92 of the Commonwealth Constitution, which provides for free and unrestricted trade between the federated States.

Against that there is the existing dried fruits legislation, which provides definitely for certain powers whereby section 92 is differently construed. The general belief to-day—and that belief is strengthened by the most recent decisions of the High Court—is that section 92 binds the States, but is not binding on the Commonwealth itself. The Commonweatlh exercised its powers by the passage of the Dried Fruits Export Control Act, by which section 92 is overridden in certain details, and by which State functions are limited in certain directions, except with the legislative concurrence of the Commonwealth Government. The ministerial conference last March, realising the necessity of farmers' marketing organisations being soundly based and insusceptible to legal attack, reviewed the whole question of commodity marketing. The outcome was a recommendation to the Premiers' Conference that the Commonwealth Government be asked to introduce legislation for the appointment of marketing boards in each of the States, similar to that constituted under the Dried Fruits Act, for the control and disposal of primary products. The Commonwealth Government, apparently, was constrained to agree to a general form of organisation if a definite desire for it were shown by any particular industry, and if it were generally acceptable to that industry. Up to the present, only one

definite demand or request has been submitted, and that by the dairy industry. The real point involved is the application of the dried fruits legislation to the dairy industry of the whole Commonwealth. Further consideration was given to three questions: Fixing a limit of production below which any scheme for stabilisation will not apply; fixing a maximum price for local consumption; and fixing a period for the duration of the scheme. All the States have agreed to the basic principles of the Queensland Bill.

The object of the proposed legislation is to stabilise the dairy industry throughout the Commonwealth, which, of course, is beyond the power of one State. The equitable determination of home prices and the limiting of fluctuations in export parity are the general underlying principles of the new legislation. While it provides for a common basis of action, variations in domestic practice in the States concerned will be recognised. Its period of operation is limited to three years. Under the new measures, State organisations are supplanted to a great extent by a Commonwealth organisation within which State organisations will function.

All this was explained by Mr. Bulcock in his introductory speech. He expressed a belief in an Australian parity for butter, and regarded the old idea of fixing our domestic price on the violent fluctuations of the overseas market as unfair to the producer and consumer alike. Victoria was, apparently, reluctant to come into the stabilisation scheme. "To-day," said Mr. Bulcock, "the three Eastern States of the Commonwealth are legislating in this direction, and we are asking the Commonwealth Government to proceed with the other necessary legislation as soon as possible."

The Stabilisation Scheme.

EXPLAINING the Bill further, Mr. Bulcock said:—

> The scheme is not an elaborate one. It provides for the setting up of a stabilisation board in Queensland. It was never my intention or desire to create a new board. We have elected representatives of the dairying industry on the Butter Board and Cheese Board, and a judicious selection from these people—allowing the selection to rest with them—will meet all requirements so far as the Queensland Board is concerned. Representatives from this board will function on the Commonwealth Board. The whole idea is to allocate quotas to the various States of the Commonwealth in respect of domestic consumption and export. The quotas will be decided on the requirements of the various States and on the production of the various States. Each State will take its fair share of export parity, and each State will get its fair and reasonable share of domestic consumption. Such a scheme does not involve the transference of a dairy commodity from one State to another. The scheme will be carried out by bookkeeping transactions, with transfers of quotas to the domestic side or to the export side, as the case may be. The machinery that will be utilised will be the machinery that will be evolved by both Commonwealth and State Governments. The objective will be achieved, I think, in a way that will meet with the satisfaction of those people engaged in dairying practice, and it will not operate to the disadvantage of the consuming public.
>
> There is one further matter that I should like to mention at this stage. It is in connection with the Paterson scheme. For some time we have been operating a scheme whereby an effort was made at stabilisation, but some people have contended—and rightly so, I think—that the Paterson scheme could not survive any great increase in the proportion of butter that is exported overseas. I believe that viewpoint to be the correct one. The Paterson scheme on the present expansive export will probably not survive more than another couple of years. If then the Paterson scheme is to fail it becomes necessary to have a scheme which will function side by side with the Paterson scheme, and ultimately when it fails, to take its place and act as a stabilising influence on the Australian market. There is nothing inherently wrong with the Paterson scheme, but the distribution of domestic and export quotas obviously must kill it in the final analysis. . . . This is a very genuine effort on the part of the Australian States to establish an Australian stabilised price of butter. It can succeed. We have the machinery that has been in successful operation under the Dried Fruits Export Control Act to indicate the course we must take. In Queensland we have the domestic machinery to enable us to operate this scheme. I feel some gratification in the fact that the necessity for this move has been realised after many years. I know that the ex-Minister (Mr. Harry F. Walker), the hon. member for Cooroora, was ultimately interested in this matter, but Victoria was the major stumbling-block at that time. This difficulty has been overcome, and the stabilisation which will be achieved under this Bill will be of very considerable benefit indeed, not only to the people engaged in the dairy-farming industry in Queensland, but also to all those in the Commonwealth.

Dairying in Queensland—Another Record Year.

YET another annual record has been achieved in dairy production, the factory output of butter exceeding that of the previous year by nearly 5,000,000 lb., notwithstanding the climatic vagaries that contributed so much to comparatively low-crop results in other branches of husbandry. The actual outturn from our butter factories was 100,028,578 lb., as against 95,050,738 lb. for 1931-32, and 92,894,101 lb. for 1930-31; yet, as suggested, seasonal conditions were against high production. General rain, so important to the maintenance of an average output, was not experienced in dairying districts. Generous storm rains in some areas varied with light and patchy falls in others. The summer was unusually hot and dry, to the detriment of grass and fodder crops, and, consequently, to the quality and volume of the product and the regularity of supplies.

The sharp upward curve in the production chart is attributed to the entry into the industry of farmers who had previously limited their operations to grazing and/or general agriculture. Low wool and meat values and the unfavourable season for arable farming forced both the grazier and agriculturist into dairying, especially on country conveniently situated within a butter factory zone. Another important factor that influenced output was the opening and occupation of large areas of Crown lands in different parts of the State. The development of the industry in the tropical coastal country from Mackay northwards was another contribution towards the attainment of the "peak" in butter tonnage.

In his annual report to the Minister, Mr. E. Graham, Under Secretary and Director of Marketing, calls attention to the foregoing facts, and remarks further that in North Queensland the industry is advancing rapidly and on a high plane of technical efficiency. This remarkable development of dairying within the tropics was mentioned in his last review, and he has the satisfaction of reporting still further progress. Climate, soil, and other natural advantages, together with the adoption of modern methods in dairy practice, are making Queensland a great dairying country.

From Mr. Graham's review of the year in dairying, we learn that grading records show considerable improvement in quality and a commendable uniformity of factory products. The body, texture, and general condition of butter were satisfactory, an indication of a high degree of efficiency in the manufacturing side of the industry.

Hugh summer temperatures affected detrimentally the quality of a proportion of the cheese outturn. The disadvantages of hot weather can be minimised by a wider application of the information disseminated by the Department, and this was an important point in its instructional programme. It is noteworthy that most dairy farmers deliver a high-grade milk to the cheese factories, thus demonstrating that the difficulties of cheese production in a sub-tropical climate can be successfully overcome. There was an appreciable increase in the cheese output for the year, the aggregate being 13,079,996 lb., as against 11,006,663 lb. for 1931-32. The services of the Departmental instructional staff proved effective in increasing the quantity of first-grade cheese manufactured during the period.

Investigatory work in respect to both butter and cheese was an important branch of Dairy Branch activities in the course of the year. Short refresher courses for dairy factory employees and dairy farmers were well attended, and their beneficial influence on the industry is undoubted. Herd-recording was continued energetically, a new departure being the enlisting of the co-operation of dairy factory managements in this important work. Breeders of stud dairy cattle are making greater use of the facilities afforded by the Department in respect of advanced register recording.

The amendment of the Dairy Produce Act, passed last session, has made possible the more complete inspection of dairy factory accounts, resulting in uniformity in the compilation of annual returns. The general inspection disclosed that sound methods of accountancy are the rule in all factories.

Under amending legislation, the payment of freight on cream by co-operative dairy associations was abolished in the course of the term under review.

In the course of the year "*The Dairy Cattle Improvement Act of* 1932" became law. Its object is to assist dairy farmers to head their herds with bulls bred on production lines, to extend the herd-recording service, and to co-operate with the Animal Health Station in the control or eradication of stock pests and diseases.

The establishment of the Dairy Committee Scheme was an addition to the educational activities of the Department. The scheme has been generally approved by local producers' associations, and 105 local committees have been formed under an acknowledged leader in the industry.

Bureau of Sugar Experiment Stations.

CANE PEST COMBAT AND CONTROL.

By EDMUND JARVIS.

It is proposed to publish each month a short paper describing the movements of this insect, either above or below ground, according to the time of the year; together with descriptive details of a nature calculated to assist canegrowers in the study of this pest in every stage of its life cycle. Mr. Jarvis's entomological notes are always interesting, and this additional monthly contribution will be welcomed by our readers who are engaged in the sugar industry.—EDITOR.

GREYBACK CANE BEETLES EMERGE FROM THE GROUND—FIRST APPEARANCE OF EGGS AND YOUNG GRUBS IN CANE LAND.

Our first heavy rains often fall in November, and in the event of September and October having been dry months a precipitation of 3 or 4 in. is invariably followed by a primary emergence of this beetle pest. If rain comes early in November, but lasts only a few hours, we may expect a secondary emergence later on, after another downpour, either at the end of November or early the following month. During September the pupæ of the cockchafer were mostly in evidence (see Plate 59), while the month of November is characterised by the occurrence of multitudes of the beetle-form of this pest patiently awaiting underground the coming of rain which will enable them to reach the surface and take to wing. Should dry weather continue, however, throughout November, a certain percentage of greybacks chancing to occur in light soils of high porosity can still manage to escape imprisonment. Such specimens can easily be distinguished by their dark reddish-brown colour, which is due to the white body scales having been rubbed off by contact with the hard dry earth during the course of their difficult passage upwards.

It will be seen from the following table that primary emergencies of this cockchafer may happen as early as 15th October, or as late as the middle of January:—

Record of Past Primary Emergences of Greyback Beetles.

Year.	Month.	Year.	Month.
1914	5 December	1924	13 December
1915	11 December	1925	18 November
1916	7 November	1926	18 December
1917	29 October	1927	20 December
1918	15 October	1928	12 November
1919	15 January	1929	19 November
1920	5 November	1930	30 November
1921	2 December	1931	27 December
1922	22 December	1932	15 December
1923	7 December		

Although November and December are evidently the two principal months for its appearance on the wing, its existence occurs most often during December. In years when "flighting" happens to take place towards the end of the latter month, it is worth noting that such conditions are likely to favour subsequent fumigation of its grubs by curtailing the activities of this pest during such late seasons to a single emergence of the beetles.

Factors Influencing the Migration of Greyback Beetles.

The natural laws which govern the movements of certain insects are too complex to deal with here, but it may be stated that several species, including our greyback beetle, when chancing to multiply abnormally over restricted areas, sometimes seek to migrate to fresh fields, and thus ensure a wider distribution of eggs. By establishing their grubs or larvæ on different kinds of soil they may thereby lower the percentage of mortality caused by natural enemies or obtain greater abundance or variety of food.

It will be of interest to mention that the grub-infestation of cane lands surrounding the Mulgrave Mill was apparently effected in the early days by greybacks that migrated there from extensive breeding grounds lying to the south of Aloomba, between the Malbon, Thompson, and Pyramid Ranges. Fully one-third of this area of about 80 square miles consisted at the time of reserved land, including much virgin scrub, uncleared forests, and open country supporting native grasses, &c.

The plate for November illustrates the awakening to activity of the first lot of geryback cockchafers, eggs being laid, beetles emerging from the ground, and feeding on eucalyptus leaves.

PLATE 111.—Showing activities of the greyback beetle about a fortnight after the first heavy fall of rain. Specimens (left to right) (1) escaping to the surface from cell; (2) laying eggs; (3) tunnelling downwards to oviposit; (4) reaching the surface; and (5) not yet ready to emerge from cell.

Fertilizers for Sugar Cane.

By H. W. Kerr.

IT has been pointed out on several occasions that the cane soils of Queensland are not possessed of the high degree of fertility which is so frequently attributed to them. Certainly there are restricted areas of highly productive soil, such as portions of Freshwater and the Burdekin Delta; but, in common with other tropical lands of heavy rainfall, the plantfood supply of the soil has been rapidly depleted, due to the excessive leaching to which they are subjected; the first flush of high productivity for which they are noted when first brought under cultivation rapidly passes, and the farmer must then pay very close attention to the maintenance of fertility if he would continue to harvest satisfactory crops.

Although a large proportion of our canegrowers are consistent users of fertilizers, there are still many who do not devote to these materials the attention which their importance demands. It is pleasing to note that the early prejudices which were entertained against these valuable materials are rapidly disappearing; but even to-day artificial manures are spoken of as crop stimulants—substances which transmit to the crop an unhealthy growth impetus, and which will eventually ruin the land. Used wisely, nothing could be further from the truth. Fertilizers are simply concentrated forms of plantfood, the application of which to the land serves but to restore something of the fertility which continuous cropping to cane removes from the land.

Sugar-cane must be regarded as a gross feeder on the plantfood of the soil. Calculations based on analyses show that a ton of cane removes as much plantfood as would be supplied by 25 lb. of mixed fertilizer. A 30-ton crop would, therefore, deprive the soil of the equivalent of 750 lb. of mixed manure. Is it to be wondered, then, that the harvesting of heavy cane crops without heavy manurial applications to the land soon results in rapidly declining crops?

It has been shown that crops extract from the soil seven plantfood materials which are absolutely essential to growth. If one of these is lacking, crop production is impossible; if one or more is present in deficient amounts, yields are reduced proportionately. In practice it is found that three of these plant foods in particular are likely to become factors limiting crop growth; they are nitrogen, phosphoric acid, and potash. It is for this reason that *mixed* fertilizers contain these three plant foods in varying proportions. Other manures, such as superphosphate or sulphate of ammonia, supply only one of these particular foods.

As might be expected, soils vary widely in their ability to supply the desired amounts of these individual foods, and, therefore, the particular fertilizer mixture which will give most profitable results will vary in composition for different soil types. Thus the red volcanic soils of this State show a consistent deficiency with respect to potash, and a suitable mixed fertilizer should, therefore, be rich in this plant food. On the other hand, the acid alluvial soils of North Queensland exhibit very marked response to heavy applications of phosphates, but are able to provide for the potash needs of heavy crops of cane without substantal dressings of this plant food.

The determining of the particular requirements of the major soil types of the sugar areas has been one of the projects pursued intensively by the Bureau during the past four years. Fertilizer trials have been established on suitable areas of typical soil, and on the basis of the crop yields from the several treatments we have been able to select that fertilizing mixture which might be expected to return the grower the maximum profit for the value expended. In the far northern areas our trials have been particularly successful, and we are able to advise growers with a reasonable degree of certainty just what their soil most requires. This is certainly true for the red volcanic, alluvial, and gravelly soils of those parts. As regards the red schist soils, which rival the alluvials in point of importance in those districts, our results have not been so clear-cut. Certain of these soils exhibit marked response to potash-rich mixtures, while others—often not more than a mile away —have been found to be distinctly deficient in available phosphates. while the increased yield due to potash is of minor importance. It does appear, however, that our laboratory chemical tests on soils of this type reflect these conditions, and we would urge growers farming this particular type to submit samples to our laboratories for analytical purposes and advice.

If any doubt exists in a grower's mind as to whether the fertilizer he is using is suitable for his particular conditions, he should consult our Field Officer or Station Chemist, who will advise him of our findings, or will undertake to submit a soil sample for analysis should this course be deemed advisable.

The soils of the Burdekin area have already been mentioned. Here it is found, by field trial, that the richer soils of the area show but slightly increased yields from phosphates or potash, but phenomenal increases have been recorded following applications of sulphate of ammonia. This is particularly true of ratoon crops. One such experiment harvested during the present season showed 39 tons of cane per acre unfertilized, and 53 tons per acre where liberal dressings of sulphate of ammonia had been given. It now appears quite definitely that the failure of ratoons in that district is attributable in a large measure to inadequate supplies of plant food early in the lifetime of the ratoons, and this is especially true of the plant food nitrogen.

Our results in the central and southern areas have not been so complete as those in the far northern districts. This is doubtless due to the decidedly droughty conditions with which these areas have been afflicted during the period under review. It must not be concluded, however, that our results have supported the oft-repeated statement that fertilizers are not required on these soils. On the contrary, it might be demonstrated that in a dry year the richer soil definitely outyields the poorer one; but the fact is that soil moisture has been so seriously deficient that the added plant food was not able to demonstrate its true value. It is hoped that a return of favourable seasons may enable us to prove this contention in no uncertain manner.

For the present we can only state that the red volcanic soils of these parts require a mixture rich in potash, and that forest sandy loams are usually lacking in available phosphates.

So far very little has been said regarding nitrogen—the plant food supplied by sulphate of ammonia. Our experiments have shown that practically all soil types give markedly increased yields where this

material is applied. The nitrogen content of the land is intimately associated with the soil humus; and soils deficient in humus are, therefore, deficient also in nitrogen. This is particularly true of older lands, on which continuous cultivation over a period of many years has resulted in a rapid loss of humus. The ploughing-under of green manure crops on all soil types is to be definitely encouraged, therefore, if for no other reason than that the practice affords a cheap and ready means of building up a supply of available nitrogen in the soil. Indeed, we have found that, where a good crop of beans or peas has been ploughed under and rotted prior to planting cane, very slight response to added sulphate of ammonia can be detected.

The favourable influence of the leguminous crop is, however, fleeting; for the subsequent first ratoon crop has almost invariably shown a highly increased yield due to top-dressings of sulphate of ammonia. This fact should, then, be kept clearly in mind—that, although the plant cane may find all of the nitrogen which it requires for its growth, the ratoons will certainly benefit from application of this plant food. On certain of our soil types we have found that applications of 600 lb. of sulphate of ammonia per acre to ratoons are profitable. This is, of course, applied in two or three light dressings.

As regards the time and manner of applying fertilizer, we would suggest the methods which have been followed in all of our trials with success. To make best use of the supplementary plant foods applied in this manner, the crop should be able to draw on them as early as possible in its lifetime. For plant cane we would, therefore, recommend that the manure be placed in the drill with the cane plants; for ratoons, apply in a furrow 3 or 4 in. deep run close to the line of stools at ratooning time. Our experiments show that fertilizer applied early may result in added crop yields of several tons per acre, as compared with the same manure applied later.

This recommendation regarding the placing of the manure is not strictly accurate. In other words, we recommend that all phosphates and potash be applied at planting or ratooning time, together with a proportion of the nitrogen—for preference, in the form of meatworks manure. The bulk of the nitrogen is applied later in the form of top-dressings of sulphate of ammonia. It is found that best results follow this method of fertilizer application, and sulphate of ammonia appears to give maximum increases when applied in dressings each of 1 bag per acre. Thus it is desirable to apply such a dressing when the plant cane is stooling, and probably another of similar amount from four to six weeks later. For ratoons, an application should be made shortly after ratooning, and in this case two further dressings—at, say, monthly intervals—should be given. It should be remembered that heavy dressings of sulphate of ammonia applied late in the season result in delayed maturity and marked reduction in the c.c.s. of the crop. As far as possible, growers should aim at completing their fertilizing programme before Christmas time. Sulphate of ammonia may be applied—always as a top-dressing—even in dry weather; it is then ready for absorption by the soil with the first rain that falls, and becomes of benefit to the crop immediately.

Maori Mite Control.

By W. A. T. SUMMERVILLE, M.Sc., Assistant Entomologist.

IN most of the citrus districts of this State the mite, which produces the skin blemish on citrus fruit known as "Maori," commences to breed freely about this time of the year (November), and many orchardists will need to combat the pest in the near future if they are to harvest clean fruit next year.

The Maori Mite.

Though the effect of the feeding of the "Maori" mite is well known to almost all Queensland citrus growers, there are a large number who are not familiar with the pest itself. Unfortunately, by the time the fruit shows sufficient evidence of damage to attract notice, it is usually too late to accomplish much by controlling the pest. Growers should, therefore, familiarise themselves with the appearance of the mite, and also learn at least the essential points of the life history.

The eggs are laid on the leaves and fruit and are generally placed in the less exposed positions thereon. They are minute spherical bodies, scarcely visible to the naked eye, and are usually found only when in a group and then only by a person using a lens.

The young mites and the adults are very small creatures and usually it is a colony that is found rather than one individual mite. With the aid of a lens they can be seen to be rather wormlike creatures, tapering towards the posterior end. The body has the appearance of being composed of a series of rings or hoops, each hoop being divided into two as it nears the under part of the body—i.e., there are twice as many rings on the under surface as there are on the upper surface. The mites are about three times as long as broad, and the colour varies from cream to a fairly deep yellow.

The mites move about somewhat freely, but do not appear to migrate far from the site on which they were hatched. Thus a colony may gradually build up on one part of a fruit; and ultimately enormous numbers may be present on that part, whilst the remainder of that fruit is quite free of the pest.

The mite moults twice as it grows to maturity and the cast skins commonly remain on the plant amongst the colony. The presence of these white cast skins is quite characteristic, and often the skins serve for identification of the cause of a blemished fruit after the living mites have been removed by rain, mechanical rubbing, or other such cause.

Injury.

The injury is usually confined to the fruit if these be present, but leaves are also sometimes attacked to a marked extent, especially on younger trees. The mites feed by piercing the surface cells of the part attacked, and the injury thus caused manifests itself in characteristic markings. The details of the injury need not concern the reader, but a knowledge of the general appearance of the attacked fruit is of value as a means of identifying the cause in some cases.

On green fruit the injured part at first appears as a somewhat darker area than the remainder of the rind. On orange and mandarin fruit these areas soon turn to a brown varying in depth of colour from light

to almost black according to the degree of attack. On these varieties the colour is sometimes a silver grey in the early stages, but this does not persist.

The damaged portions of lemon fruit are quite different in appearance. On these fruits the injured areas become a silver grey or almost white in colour, and the surface may crack badly, the silvered portion then being made up of a number of small areas, isolated from one another by these cracks.

The damage to the leaves is never of any great moment, but it is useful to know the appearance so that the presence of the mite may be detected earlier than might otherwise be the case. The mites are usually to be found on the lower surface of the leaf only, though the upper surface is sometimes attacked. The damaged leaves at first appear bronzed, a stage which is more often noted on lemons than other varieties, but in most cases the first noticeable damage is when dark-brown patches of irregular shape appear on the leaves. Though there is little similarity, this damage by the "Maori" mite is frequently confused with melanose disease.

In general the greatest injury suffered by growers through this pest is due to the reduction in the grade of the fruit owing to the skin blemishes, whilst in more severe cases the fruit may be rendered unfit for market. At times the infestation is so heavy that the fruit drops from the tree prematurely. There are other effects such as reduction in size and interference with normal juice production.

Control.

The mites breed very rapidly in the summer months and enormous populations may thus be built up quickly from very few original mites at this period of the year. In typical summer weather in this State the mite may take only a little over a week to complete its life cycle. Generations thus follow one another in rapid succession, and it will be be readily understood that if combative measures are to be at all effective they must be very efficient. Further, it will be seen that even if a very high percentage kill be obtained early in the summer, this does not ensure that further combative measures will not have to be taken later in the season. Actually it is commonly found that no matter how complete the control established in the early summer, there is always a probability that a second application of the lethal agent will be necessary towards the middle or end of that season. Control should be established towards the end of November or early in December. The trees should then be kept under close observation from the beginning of January, at least until the first week of March. If the weather remains warm well into March it is quite possible that the "Maori" mite will remain active enough to cause considerable damage even to the end of that month.

Both sulphur and lime sulphur are effective against the pest. The procedure recommended is to spray the trees with lime sulphur in the latter part of November or early in December. The strength of the lime sulphur depends largely on the weather conditions, but in general the material should be applied at a strength of between 1 in 20 and 1 in 25. If observations suggest that further treatment is needed later in the season, as is very possible, either lime sulphur or sulphur dust may be used. Of the two, at that time of the year, the dust (flowers

of sulphur) has most to commend it. Dusting may be carried out at any time of the day, but the best results will be obtained by working either late in the evening or early in the morning when dew is on the trees. If the wet spray be preferred there is no necessity to use it stronger than 1 in 30, and 1 in 35 suffices unless it is to be applied very late in the season.

Oil sprays are sometimes used to combat "Maori" mite. These sprays at their best are only partially effective for such a purpose and as has been pointed out, the material, to be of any lasting value, must be very efficient. Oils, therefore, should not be used for the control of the "Maori" mite.

"DONTS" FOR DAIRY FARMERS.

The manager of the Singleton Central Dairy Co-operative Dairy Company, Limited (New South Wales), Mr. G. Searl, gave a list of dairying "dont's" at a recent conference of the New South Wales Agricultural Bureau, which are worth repeating. Some of them are growing whiskers, we know, but good points are always worth repetition. Here is the list:—

Don't use cloths in the dairy—use brushes.

Don't leave skim milk about to go sour.

Don't leave utensils unscalded.

Don't fail to use boiling water to wash out the cloths used to wash the cows' teats and udders.

Don't put milk or cream in the cans which come back from the factory until they have been *scalded,* scrubbed with a brush, and aired.

Don't put a little night milk into the morning's can to fill it up.

Where milking machines are used, don't dip the tea cups in the water used to rinse the milk line—such water may spoil the milk and bring an inspector.

Don't fail to examine the milk pipe line and see that the tinning is perfect.

Don't fail to inspect the corners and crevices of the milking machine.

Don't fail to wash the hands with a clean cloth and water.

Don't fail to study the physical condition of the herd. This is more important than one would think. Especially is this very marked in drought time. The cow has the natural mother instinct very firmly rooted. With the natural resources of the body reduced to a minimum the cow commences much earlier to store up nutriment for the time when the calf arrives. Consequently, an animal which in an ordinary good season would give good milk up to six weeks before calving, would, under dry conditions, commence to reduce her milk yield three months before. A sick cow in the herd will spoil all the product.

Don't fail to examine the water supply used for both drinking and washing-up purposes. An epidemic of "ropey" milk and cream from one district was found to be caused by the wells getting low. They were cleaned out and the trouble disappeared. Low dams or creek holes are likely to give trouble.

Don't wash up with anything but boiling water, and don't rinse the utensils after washing with anything but boiled water, unless very sure that the source is good.

Don't feed on scorched young corn or water-logged saccaline.

Don't keep the cream lorry waiting, and don't let the lorry keep you waiting. Early delivery to the factory ensures quick treatment. Late deliveries have to wait in the lorries in the heat and so deteriorate.

The roadside pick-up should have a proper shelter, either built or thick foliaged trees. In the case of milk, one hour standing still is worse than two hours moving along.

Potato Diseases.

By R. B. MORWOOD, M.Sc., Assistant Plant Pathologist.

THE potato, unlike most agricultural crops, is grown from tubers and not true seed. The tuber, being a vegetative portion of the plant containing abundant food and also a high degree of moisture compared with seeds, forms an ideal means for the survival of plant disease from one crop to the next, and the spread of disease from district to district. The importation of potatoes from the older countries has in the past brought the majority of the diseases of this crop to Australia. Strict quarantine measures are now enforced to debar the entry of the few remaining serious diseases.

Potato diseases are caused by the action of parasitic fungi and bacteria and by infectious viruses. There are also a number of disorders, known as physiological diseases, which are due to unsuitable conditions of growth or storage. The diseases occurring in Queensland are discussed in the present article, and brief reference is also made to two diseases not yet recorded in this State.

IRISH BLIGHT.

This disease, which was responsible for disastrous famines in Ireland when that country was dependent on its potato crop, is still capable of causing the most devastating effect on a crop, when no adequate control measures are adopted and conditions suit the disease.

Symptoms.

Irish blight is first recognised as black spots on the leaves. These spots may be dried out by the sun, or may spread to involve all the leaf tissue, the leaf stalks, and finally the stem (Plate 112). When the stem is severely attacked the plant dies right down to the ground. The tubers if present may be affected either by the disease spreading down through the underground stems, or by direct infection of exposed surfaces before or after digging. The tuber symptoms consist of a sunken and darkened skin, beneath which are areas of brown tissue extending to varying depths into the potato. Under moist conditions of storage the tubers may rot away completely.

Cause.

The disease is caused by the fungus *Phytophthora infestans*, which in moist weather produces spores on the surface of the black spots just described. The spore producing portion can be seen with the unaided eye as a delicate white down. The spores themselves, which can be regarded as minute fungus seeds, are blown about and alight on leaves and other portions of the plant, and if moisture such as a drop of dew is present they germinate. Germination consists of sending out a thin hairlike tube which penetrates the plant and grows about inside the tissues, killing the parts invaded. Finally it comes to the surface to produce the spores already mentioned.

Contributing Conditions.

It will be readily realised that moisture is necessary for the development and spread of the disease. In addition to moisture, the temperature is an important factor. It is one of the diseases which are favoured by

PLATE 112.—POTATO LEAF AFFECTED WITH IRISH BLIGHT.

cold weather. In Southern Queensland two crops of potatoes are normally grown, one in the Spring and the other in the Autumn. Irish blight is liable to be serious in the cooler months of these two growing periods, i.e., early in the development of the Spring crop or late in the development of the Autumn crop. On this account the name, Late Blight, by which the disease is known in colder countries where but one crop (Summer) is grown, is inappropriate in Queensland. Hence the use of the alternative name, Irish blight.

Control.

The use of sound seed and rotation of crops are important in the control of Irish blight, but the principal control measure consists of preventing the entry of the disease to the plant by the maintenance of a protective covering of spray. The most successful spray to use is Bordeaux mixture, though Burgundy mixture may be used if any difficulty is encountered in obtaining good quick lime. The spray is a preventive and not a cure, so should be applied to the plants regularly before the disease appears. If the disease is present to the extent of a few leaf spots only then spraying will check its spread, but if it is severe nothing will eradicate it from the plants. Directions for the preparation of the spray are given at the end of this article. It should be applied three to five times during the growth of the crop, the frequency depending on the weather conditions, less frequent sprayings being required during dry weather. Plants should not be sprayed when they are wilting from want of moisture or some spray burn may result.

TARGET SPOT.

The first disease dealt with caused a spotting of leaves during the cooler weather. Target spot also causes leaf spotting, but is most common in the hotter months. Its effect on the plants is not nearly so severe as that of Irish blight, from which it can be distinguished by the more definite outline of the spots and by their having a number of concentric rings resembling a target. Unlike Irish blight, the stems and tubers are very rarely affected. The disease is caused by the fungus *Alternaria solani*. The same spray schedule as advised for Irish blight will hold target spot adequately in check.

FUSARIUM WILT AND DRY ROT.

Fusarium wilt in the field is typified by the drooping of individual plants as though they lacked water. On cutting the stem of an affected plant it will be seen to have a number of internal brown streaks running along it corresponding with the water conducting vessels of the plant. The tuber stage of this disease consists of an irregular dry brown rot with obvious patches of white or slightly coloured mould either on the surface or in internal spaces in the tuber. The diseases are caused by closely related fungi *Fusarium* spp., the wilt in the field being due to *F. oxysporum*, and the tuber rot to this and a number of other species. It is the latter stage which is sometimes serious in Queensland, the wilt being rarely met with. The control of the tuber rot consists of bagging only sound healthy tubers and careful digging and handling to avoid all injury to the skin of the potato.

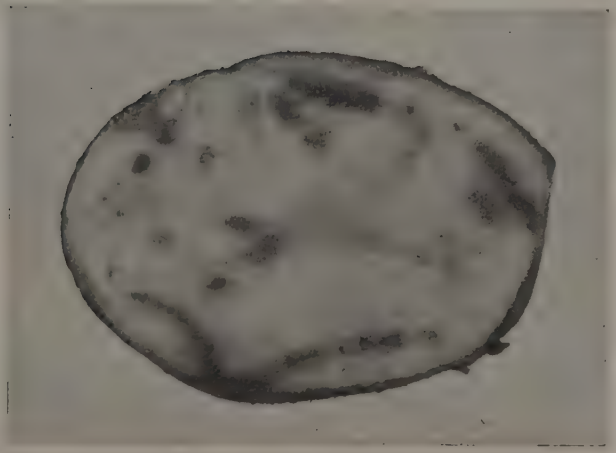

PLATE 113.—BACTERIAL WILT.
Fig. 1.—Potato plant exhibiting foliage symptoms.
Fig. 2.—Affected tuber.

BACTERIAL WILT.

Bacterial wilt resembles Fusarium wilt in its general effect (Plate 113), but the internal symptoms are different. The water conducting vessels are not turned brown, but they are filled with bacteria which appear, on cutting the stem, as drops of ooze on the cut surface. The tuber exhibits a wet rot which under moist conditions in a bag spreads rapidly and destroys the whole tuber, then spreading to neighbouring potatoes. The disease is caused by *Bacterium solanacearum*, and is of somewhat frequent occurrence in Queensland, but is usually responsible for the loss of only a small percentage of the crop. Its control is considered at the same time as that of a second bacterial disease next described.

BLACKLEG.

The most conspicuous feature of this bacterial disease is a soft black rot of the stem from ground level for six to twelve inches up. The tops above the affected area wilt. The tubers are affected by a soft rot similar to that of bacterial wilt.

Control of the bacterial diseases consists of rotation of crops, care in the selection of seed to use only sound tubers, and good storage conditions for all tubers, but especially those to be used for seed. In the case of blackleg, treatment of the seed to destroy surface borne organisms has been shown to be of some benefit.

SCAB.

The disease of potatoes most frequent occurring in Queensland is common scab. This disease affects only the tuber, producing cracked and scaly areas, and depressions on the surface of the potato (Plate 114, fig. 1). The trouble does not penetrate deeply and there is little direct loss of the edible portion. However, scabby potatoes will not keep, as the affected area allows the entrance of organisms causing rot, which soon cause the breakdown of the tuber in storage. On this account, as well as the unsightly appearance of the potatoes, all scabbed potatoes should be sorted out when digging, and no attempt should be made to dispose of them by sale in the ordinary way. They may be used for pig food.

Cause.

Scab is caused by a lowly fungus organism. It forms a delicate surface growth, and the scab is formed by the reaction of the potato to the irritation of the fungus. The organism is introduced on seed potatoes, and survives in the soil for a number of years. It is serious on land having a neutral or alkaline soil reaction, and the acidification of the soil with sulphur has been advocated for the control of the disease. The process, however, is somewhat expensive and it has not been extensively practised.

Control.

Recommendations for the control of the disease consist of long rotation of crops, seed selection, and seed treatment. If sufficient potato land is available only one crop should be grown in the soil and then it should be cropped to lucerne or other crops for three of more years, when potatoes can again be planted.

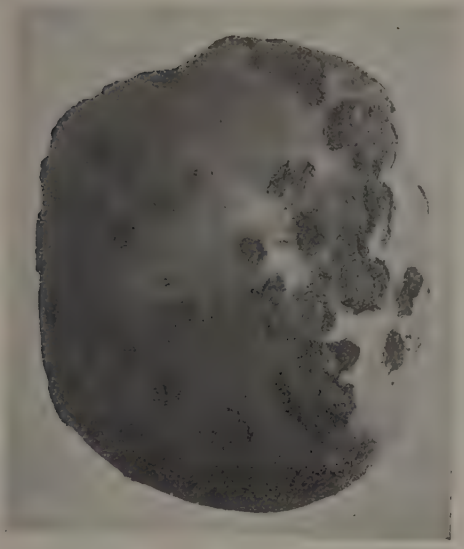

Fig. 1.

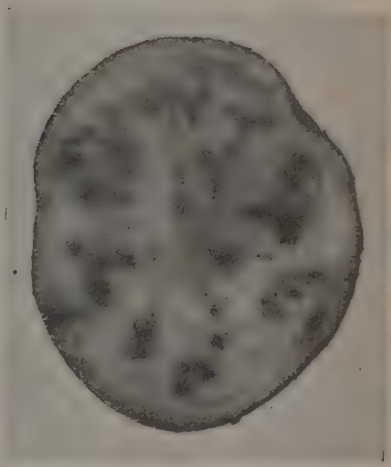

Fig. 2.

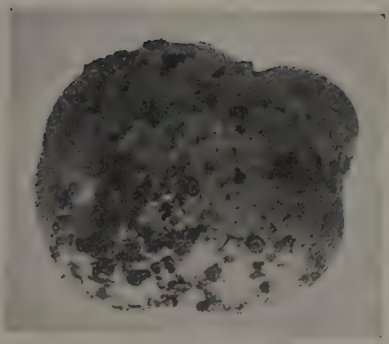

Fig. 3.

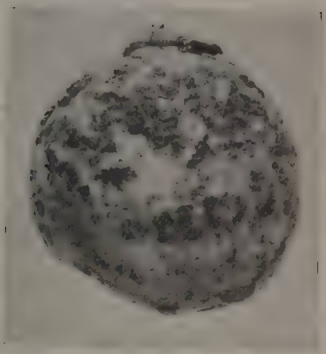

Fig. 4.

PLATE 114.—POTATO TUBER DISEASES.

Fig. 1.—Common scab.
Fig. 2.—Brown fleck.
Fig. 3.—Powdery scab.
Fig. 4.—Black scurf.

Seed should be selected which is free from any obvious signs of scab, and as a further precaution should be treated with hot formalin or acid corrosive sublimate. The details of the strength and method of using these substances are given later. Treatment will effectively prevent common scab and the disease next to be described, black scurf, and it will also destroy a portion of the infective material of other diseases, notably that part which happens to be carried on the surface of the seed tuber.

BLACK SCURF.

A second type of scab of the potato produces small black lumps on the surface. These lumps resemble black soil, but may be distinguished by the fact that the lumps cannot readily be washed off. They are an intense black colour when wetted (Plate 114, fig. 4). These lumps are sclerotia or fungus resting bodies which revive when the tuber is planted in moist soil. The fungus then produces a mould-like growth which attacks the stalks of the plant about ground level. The affected stalk rots away or, if dry weather supervenes, it shrivels and the top of the plant dies. A common feature of this phase of the disease is the production of aerial tubers, i.e., swellings appearing on the stems of the plant resembling tubers, but being green, soft and useless. The fungus causing the disease, once known as *Rhizoctonia solani*, is now referred to as *Corticium solani*.

The control of this disease consists of the same precautions as are taken to prevent common scab, viz., crop rotation, seed selection, and seed treatment.

MINOR ROOT AND STEM ROTS.

There are two other fungi occasionally found parasitic on the potato in Queensland, namely *Sclerotium rolfsii* and *Armillaria mellea*, the former causing a rot of the base of the stem very similar to that of black scurf, and the latter a rot of the underground portions. *S. rolfsii* can be distinguished by the presence of numerous white to light-brown sclerotia about the size of small shot. *A. mellea*, on the other hand, possesses brown to black strands having the appearance of a shoe lace. No special precautionary measures are warranted.

VIRUS DISEASES.

The diseases considered so far are caused by fungi or bacteria. The effects of these pathogens are readily observed as conspicuous spots or obvious wilting and death of the plant. The virus diseases on the other hand are often overlooked by the grower, but nevertheless they seriously reduce the crop yield. They present an abnormal appearance including stunting of the plant, rolling, crinkling, yellowing or mottling of the leaves, and the development of numerous close set shoots. These diseases are sometimes known as degeneration diseases and ascribed to run-out seed. In a general sense that is correct, but the running-out is due to the spread of the diseases to a greater extent in each succeeding crop planted from unselected seed. These diseases are actually caused by a virus or infectious agent, individuals of which are so small that they cannot be seen with the highest powered microscopes, and they can pass through the finest of filters.

PLATE 115.

Fig. 1.—Potato plant severely affected with leaf roll.

Fig. 2.—Healthy plant from the same crop for comparison.

The virus spreads through all parts of the plant including the tubers. When such tubers are used for seed, the resultant plant is infected from its inception. The disease will then spread to other plants, being carried by insects such as aphids which suck the sap containing the virus from diseased plants and subsequently turn their attention to healthy ones. Plants infected by this secondary spread of the disease show the symptoms only in those leaves which are developed after infection takes place, and little direct loss results. However, the virus travels down into the tubers, which are then a potential source of serious disease in the subsequent crop. Two virus diseases are commonly met with in Queensland—mosaic and leaf roll. Mosaic is actually a group of diseases which are only distinguished with difficulty, but it is dealt with here as a single disease in order to avoid confusion.

MOSAIC.

The appearance of a potato plant lightly affected with mosaic is not very different from that of a healthy plant, but the disease is readily recognised in a badly affected plant or when an affected plant is seen growing among a number of healthy ones, when its debilitated appearance is evident by contrast. Its principal symptoms are a crinkling and yellow mottling of the leaves, with more or less stunting and bunching of the plant. The tubers cannot be distinguished from those of a normal plant, but the yield is considerably less when plants are severely affected.

LEAF ROLL.

As its name suggests, the principal symptom of leaf roll is a rolling inwards or curling upwards of the leaflets (Plate 115, fig. 1). The leaves are abnormally thickened, stiff, and pale in colour. The stiffness serves to distinguish plants affected with leaf roll from those whose leaves have curled due to the effects of dry weather, wilt, or other diseases of the stem which interrupt the supply of moisture to the tops. The tubers on a leaf roll plant are fewer in number and smaller in size, but are otherwise no different from those of a healthy plant.

Control.

Both mosaic and leaf roll cause considerable reduction in yield and should therefore be guarded against. An infected plant cannot be cured, and no spray is of any use either as a cure or a preventive. Control consists of the use of disease-free seed. This ideal is somewhat difficult of attainment, particularly in a State which is dependent on an external source of supply for the majority of its seed. In other countries elaborate schemes of seed certification have been evolved to produce seed of a high standard of freedom from virus disease and other defects. Such a scheme is warranted only when the demand exists for high-class seed at an advanced price.

For the grower producing his own seed a capital stud plot is advisable. This plot should be at least 100 yards from any other potato crop. It should be planted with the best seed procurable—preferably table sized tubers as these are less likely to affected with a virus than are the small seed. Then in addition to being well worked, it should be gone through at least three times during the growing period and all off-type and diseased plants carefully dug out. The tubers from the remaining plants should then be nearly disease free, and should all be used for seeding the next crop.

PHYSIOLOGICAL DISEASES.

In addition to the infectious diseases of the potato there are a number of diseases caused by conditions under which the crop is grown. The exact nature of these conditions is not always known, but it is fairly well established that the physiological diseases do not "spread" in the way that the fungous, bacterial and virus diseases do.

BLACKHEART.

Tubers affected with blackheart are quite normal on the outside, but on cutting are seen to have a black irregular area in the centre. Blackheart is caused by overheating or poor ventilation in storage, and can be prevented by providing better conditions.

HOLLOWHEART.

This affection is not discernible on the outside of the tuber, but consists of an irregular hollow in the centre of the potato. It is caused by too rapid growth and is not of any particular consequence.

BROWN FLECK.

As with the two previous diseases potatoes affected with brown fleck are normal on the outside. They have, however, scattered through their substance a number of small, hard, brown portions of tissue (Plate 114, fig. 2). The affected portions do not soften on cooking, and if at all numerous entirely spoil the potato. There are no parasitic organisms present in the brown tissue. The cause is not definitely known, and consequently no means of cure or prevention can be devised.

GLASSY END.

In tubers affected with this disease the central portions, more particularly towards the stem end, are watersoaked and have a translucent glassy or greasy appearance. The affected area looks dull in contrast to the crisp white appearance of a cut healthy tuber. Such tubers are frequently referred to as being soapy. The affected portions are deficient in starch, and when cooked rapidly break down into an unpalatable mush. The trouble is caused by interruption in the regular development of the potato plant after the tubers have commenced to form. If the plant receives a check in dry weather the tubers will stop growing. When rain falls it may start into secondary growth, or other tubers may form. In either case the earlier formed tubers or portion of tuber give up some of their starch content to the fresh growth, resulting in the trouble under discussion.

DISEASES NOT PRESENT IN QUEENSLAND.

Powdery Scab.

Powdery scab resembles common scab in general appearance. It is distinguished by the fact that the scabs are first raised then, after the surface ruptures, exhibit a cavity filled with brown spores from which it derives the name of powdery (Plate 114; fig. 3). Later, when the spores

drop out, it may leave quite deep excavations. Powdery scab is caused by *Spongospora subterranea*, one of the slime fungi. Cold, wet soil conditions are required for the development of this disease. Such conditions are rarely met with in the potato growing districts in Queensland.

Wart.

Wart is characterised by an irregular dark growth on the surface of the tuber, quite distinct from the various forms of scab, which are comparatively flat. Wart is caused by another slime fungus, *Synchytrium endobioticum*. It is a very destructive disease in Europe, and every effort is being made to prevent its entry into Australia. Control of the disease where it is present consists of the use of resistant varieties.

GENERAL CONSIDERATIONS.

In spite of the large number of potato diseases which have been recorded in Queensland, relatively healthy crops are often produced with little attention to disease control. However, the average production is low, being in the vicinity of 2 tons per acre as compared with 6 tons for New Zealand. Low rainfall and the prevalence of insect pests are important factors in the low average yield, but the neglect of a few simple precautions to prevent disease also occasions considerable loss. To avoid this loss every grower should follow the following recommendations:—

(1) Procure the best seed available.

(2) Treat the seed with hot formalin or acid corrosive sublimate.

(3) Cut the seed and discard all tubers showing external or internal signs of disease. When cutting seed, have two knives, one being kept in a 5 per cent. solution of formalin while the other is in use. Change the knives occasionally, and after every diseased tuber is cut.

(4) Spray the growing crop at least three times with Bordeaux mixture.

(5) Rotate the potato land to other crops, preferably lucerne.

With regard to spraying potatoes with Bordeaux mixture, it has been found that in addition to controlling the leaf diseases this spray will increase the crop yield, even when no disease is apparent. In numerous experiments including the trials carried out by the Department in Central Queensland, it has been demonstrated that the increased value of the crop will well repay the trouble and expenditure involved in spraying. It is therefore strongly recommended. Lead arsenate may be added to Bordeaux mixture when the depredations of leaf-eating beetles are observed. Home-made Bordeaux mixture should be used, as it is more economical and efficient than the ready prepared article. Directions for preparation are appended. The use of dusts cannot be recommended.

POTATO SEED TREATMENT.

Two methods are available for this purpose, one using formalin and the other corrosive sublimate. The seed potatoes are treated before cutting. They should be first washed if they have much dirt adhering.

Hot Formalin.

The formalin solution is made up by adding one pint of commercial (40 per cent.) formalin to 15 gallons of water. The mixture must be then heated to 125° F. and kept at this temperature during the treatment. The seed tubers are dipped into the solution for two and a-half minutes in small amounts in crates or loose gunny sacks, then taken out and the solution allowed to drain back into the treating tank, another lot of potatoes being then dipped. The treated tubers are covered with bags or canvas for one hour to keep the formulin fumes in. They are then spread out to dry before planting.

The even temperature can be maintained with steam heat where this is available. Otherwise a small fire may be built under the tank and carefully regulated, or some of the solution may be kept hot in a convenient boiler and added to the main tank as the solution cools. In any case the temperature must be constantly measured with a good thermometer such as a dairy thermometer, and no more than 5 deg. variation allowed.

Acid Corrosive Sublimate.

The corrosive sublimate method has the advantage that it can be used cold, but the materials are somewhat more expensive. The solution is made up by dissolving ¼ lb. of corrosive sublimate and 1¼ lb. of hydrochloric acid (spirits of salts) in 12½ gallons of water. A wooden tub must be used as this mixture corrodes metal vessels. The tubers are soaked for five minutes, then spread out to dry. The solution can be used repeatedly but loses its strength gradually, so fresh solution should be made up after ten lots have been treated. Corrosive sublimate is a deadly poison, so great care should be taken when it is used. All treated tubers must be planted to avoid all possibility of their being consumed by any person or domestic animal.

BORDEAUX MIXTURE.

Bordeaux mixture is the most valuable and widely used spray for the potato. It depends for its action on the formation of a thin film of a copper compound on the leaf. The copper is toxic to germinating fungus spores, but must be insoluble in order to prevent injury to the plant, and in order that it will not be readily washed off. The ideal in the preparation of Bordeaux mixture is the production of a fine gelatinous precipitate which will stay in suspension, and will spread well and adhere to the foliage.

Formulae.

	6-4-40.	4-4-50.
Bluestone (copper sulphate) ..	6 lb.	4 lb.
Burnt or quick lime	4 lb.	4 lb.
Water	40 galls.	50 galls.

The weaker (4-4-50) mixture is used for regular spraying and the stronger when disease is likely to be severe.

Preparation.

Dissolve the bluestone in half the required amount of water in a wooden or copper vessel. If crystals are used, this is best done by tying them in a piece of sacking which is left suspended in the top of the

water overnight. Powdered bluestone can now be obtained, which dissolves very readily. Only wooden or copper vessels can be used to contain the bluestone solution, as this chemical will quickly eat through iron. Wooden casks form convenient receptacles.

Slake the lime in another vessel by the gradual addition of small quantities of water, when the heat generated will aid the reaction. After slaking is complete, water is added to make up the remaining half of the total required. Only best freshly burnt lime should be used, as otherwise there is likely to be an excessive amount of useless residue, and the final composition of the spray will be affected. If burnt lime is not available, good quality hydrated (not air-slaked) lime can be used, but half as much again is required. It is usually difficult to prevent burnt lime from becoming air-slaked in moist climates, but this difficulty may be overcome by slaking the lime before it deteriorates, and keeping under water. For convenience in using later, store a known amount in a known volume of water.

The two solutions, bluestone and lime, are poured simultaneously through a fine strainer into a third container, or the spraying vessel, and the mixture stirred well for a few minutes. This method gives a fine gelatinous precipitate which does not readily settle out. If necessary, one solution can be poured directly into the other, provided the latter is kept well stirred during the process. Concentrated solutions should not be mixed before dilution, as the resultant precipitate tends to be of a granular formation and its spreading and adhesive properties are poor. For the same reason the two solutions should be quite cold before mixing. Bordeaux mixture should be used as soon as possible after preparation, as it loses its gelatinous nature after several hours standing and settles out in a granular form.

Testing.

It sometimes happens that the lime used is of poor quality and the resultant mixture may then contain an excess of bluestone. This must be avoided, as the soluble copper salt is able to cause injury to the plant sprayed. An excess may be tested for by applying blue litmus paper (obtainable from a chemist) to the layer of clear liquid on the top of the spray. If the colour of the paper turns to red, more lime must be added until there is no change. A rough test is given by allowing a clean knife-blade or bright iron nail to remain the mixture for a few minutes. If on removal this shows a brown coating of copper, more lime is required.

Stock Solutions.

It is sometimes found convenient to make up a stock solution of bluestone and lime: 50 lb. of bluestone is dissolved in 50 gallons of water in a wooden vessel; 50 lb. of quicklime is slaked and water added to make up to 50 gallons. The solutions will keep well if protected from evaporation. One gallon of each will contain 1 lb. of bluestone or lime respectively, on which basis the necessary dilution before mixing for the preparation of any quantity can easily be calculated.

Insecticides.

Lead arsenate and nicotine sulphate may be added to Bordeaux mixture to give a spray combining both fungicidal and insecticidal properties.

BURGUNDY MIXTURE.

This spray is more favoured than Bordeaux by some growers, as it is somewhat easier to prepare and can be used when good quicklime is not available. There is little to choose between the fungicidal values of the two mixtures when properly prepared.

Formulae.

	6-8-40.		4-5½-50.
Bluestone	6 lb.	..	4 lb.
Washing soda	8 lb.	..	5½ lb.
Water	40 galls.	..	50 galls.

Preparation.

The preparation is essentially the same as in the case of Bordeaux, using the washing soda instead of lime.

The washing soda may contain impurities, and it is therefore necessary to test for excess bluestone as in the case of Bordeaux. As an excess of soda, unlike lime, is known to cause injury in some instances, it is advisable to test the mixture with both red and blue litmus papers. If the blue paper is turned red, an excess of bluestone is present and more soda is required. If the red paper quickly turns a definite blue, too much soda has been used and more bluestone solution should be stirred in slowly until there is no colour change in the litmus.

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New subscribers to the Journal are asked to write their names legibly on their order forms. The best way is to print your surname and full christian names in block letters, so that there shall be no possibility of mistake.

When names are not written plainly it involves much tedious labour and loss of valuable time in checking electoral rolls, directories, and other references. This should be quite unnecessary.

Some new subscribers write their surname only, and this lack of thought leads often to confusion, especially when there are other subscribers of the same surname in the same district.

Everything possible is done to ensure delivery of the Journal, and new subscribers would help us greatly by observing the simple rule suggested, and thus reduce the risk of error in names and postal addresses to a minimum.

The Brown Cutworm as a Cotton Pest.

By T. H. STRONG, Assistant to Entomologist.

DURING the earlier part of the 1932-33 season, particularly during November, a very serious loss of cotton stand was experienced in many parts of the Callide Valley. Climatic conditions had been such during the previous summer and winter months that serious cutworm developments were to be anticipated with the advent of a favourable spring. The rains of mid-October produced a good supply of weeds in open areas, and, wherever these weeds were not eliminated by cultivation, a large cutworm population developed. Areas such as old wheat-fields that had been previously cultivated and allowed to stand neglected produced a particularly heavy weed growth and enormous numbers of cutworm larvæ occurred therein. It was not uncommon to find as many as fifty or sixty cutworms (*Euxoa radians* Guen.) under one weed in such areas.

The sandy alluvial loams and sandy scrub loams were undoubtedly the most susceptible, though heavy cutworm infestation took place in certain sections of the heavier alluvials. However, little development occurred in fields where the soils were for the most part of very high clay constituency.

Observations were commenced in the cotton areas during the second week of November, when the cutworm attack was in full swing and, though proved statements cannot be made as to the origin of the larvæ, most field evidence seemed definitely to indicate that no considerable larval development will take place in fields of cotton seedlings free of low-growing weeds, such as pigweed, bullhead, or hogweed. Cutworm attack upon cotton seemed to originate chiefly in two ways in the cultivated areas, the one from invasion from weedy areas outside the cotton crop itself, such as headlands or nearby fields, the other from internal or local migration from weeds, growing during the first three or four weeks after the spring rains, within the cotton fields. In the latter category is the problem of cutworm development in areas of "dry planted" cotton.

Breeding on Weeds within the Cotton Field.

In many of the cases where very heavy and widespread loss took place in the cultivated areas, as distinct from scrub-planted areas, the cotton had been dry planted. It seemed that such areas had not been harrowed soon after the spring rains, and the dangerous weeds had appeared immediately, attracting the attention of the very active moths, which lay their eggs in favourable situations on the loose shaded soil beneath the weeds. Once the eggs hatched, it was inevitable that the cotton seedlings should suffer. In the earliest instar it appears that considerable dispersal of the cutworm takes place before it settles down to feed on a host plant. Thus, whilst many of the larvæ that had hatched were still confined to their weed hosts, the young cotton seedlings had no doubt drawn the attention of quite a few, which, in this early stage, feed in groups on the leaves and do not go down into the soil during the day. Most farmers, however, only became aware of the

trouble when they commenced to cultivate the fields of young cotton and the cutworms, whose weed hosts had been eliminated, began to concentrate their activities upon cotton seedlings. At this juncture severe loss naturally occurred, and farmers usually did not know whether they should continue to cultivate or not.

In scrub-planted areas trouble of a somewhat similar nature arose in the looser loam or sandy loam areas, and much loss of stand was suffered. Here the problem is somewhat difficult to deal with, and efficient elimination of the cutworms from the area must involve some expense and quite a deal of attention on the part of the cotton-grower.

Migration from Weedy Areas Outside the Cotton Field.

The second way in which cutworm trouble commonly originated during last season was by migration of larvæ from dirty areas of weed hosts in the vicinity of the areas of cotton seedlings. Pressure of population upon the means of subsistence often forces the cutworms to migrate. In one particular case this was observed on an enormous scale, and it occurred very commonly on a smaller scale in various areas of the Callide Valley. In the former case a very heavy growth of pigweed and bullhead had occurred in an old wheatfield in the vicinity of the State Farm. An enormous larval population was produced in this area and, as the host plants were becoming exhausted, a migration involving hundreds of thousands of larvæ occurred. Disaster to the seedling cotton of the State Farm, amongst which no weed growth had been allowed and no cutworm development had occurred, was warded off by the prompt application of very effective control measures. In many sections of the district migration of larvæ took place from breeding centres to areas of "clean" cotton and, for the most part, attention was paid to it rather late by the cotton-grower, and by that time very considerable losses had been incurred.

Before entering upon a discussion of control, a short summary of significant observations made during the attack will be given. The migration of cutworms into the State Farm from the neighbouring weedy paddock commenced about the 12th November, and continued unabated until the first week of December. At this juncture a heat-wave seemed to have a devitalising influence upon the population that remained, and the attack eased off. The larvæ did not appear to thrive when the soil surface-2-inch maximum temperatures ran towards 110° F. for a period. Apparently November, 1932, provided optimum conditions for cutworm development, the atmospheric humidities remaining uniformly low or moderate and soil surface-2-inch temperatures not being excessive. The average of maximum soil surface-2-inch temperatures for November, 1932, was 96° F. as compared with the average for the years 1926-31 of 102° F. This probably explains the prolonged nature of cutworm activity last season.

By the use of furrows and bait the cotton on the State Farm was protected, but where fallowed land adjoined the weedy paddock it had naturally not been thought necessary to draw furrows. Accordingly, enormous numbers of larvæ appeared in this fallowed land, and they displayed a remarkable survival capacity on the plant material that had been turned into the soil. However, during a relatively cool period at the end of November, some of these larvæ began to attack the cotton plants of the adjoining plots. The damage done to cotton plants six to

seven weeks old was remarkable, the stems in many cases being girdled and the plants dropping over at ground level. Though this is not the only case where seedlings of this age were attacked rather disastrously, the circumstances at the time appeared rather remarkable. This particular attack was very efficiently controlled by the application of poisoned bait in little heaps at the base of the plants at the front of the attack and within the attacked zone.

The Cutworm can be Controlled.

Despite the valuable information that has been obtained and published with regard to the habits of the cutworm and its control, many farmers in the Callide Valley failed to control the pest. The fact that the State Farm not only avoided cutworm development in areas which obviously would be very susceptible if neglected, but also prevented trouble from outside sources or breeding areas, points to the fact that control measures for the insect are very effective. Certainly in this case more attention and labour had to be devoted to the matter than most cotton farmers would be willing to supply, yet the conditions of attack in this case were somewhat abnormal, and few farmers were situated so near to such an enormous breeding ground over which they had no control.

If cotton farmers wish to avoid loss from cutworm attack they must learn the habits of the responsible insect and how to control it, and also they must have on hand, when trouble is anticipated, sufficient of the necessary material—i.e., Paris green, bran, and molasses. In most cases last season when advice was sought on the matter, firstly, the trouble had been allowed to develop too far, and, secondly, materials would generally have to be obtained from Rockhampton, this involving a fatal delay.

Farmers were to be excused, to a certain extent, for an unwillingness to incur expense at this stage of the season, after the experience of the previous year, but it must be remembered that the trouble cannot be removed without a little outlay on materials and the expenditure of some personal effort and attention. It was unavoidable that serious cutworm developments should take place in open areas in the 1932-33 season as the previous dry spell had, through grass elimination, rendered such areas susceptible to heavy weed growth. But favourable conditions for serious development within the cotton fields should not have been allowed, and attack from larvæ migrating from outside areas can be efficiently controlled.

Control of Weed Growth within the Crop Essential.

The first principle in cutworm control in cotton areas is not to allow conditions favourable to the development of cutworms within the cotton field itself. That is, do not allow after the spring rains any growth of low-growing weeds within the cotton field. If the field has been "dry-planted," the harrows should be run over it as soon as possible after the spring rains, for, during the weeks following these rains, the cutworm moths will be seeking favourable places for oviposition, and such places are in the loose soil beneath low-growing weeds. If these are provided within the cotton field, subsequent dispersal of larvæ will inevitably involve the cotton seedlings. If weeds have been allowed to grow freely through the area and each weed is host to a number of larvæ, it will be fatal to cultivate without following

up quickly with an application of Paris green bait, either broadcasted over the newly cultivated area or sprinkled along the rows of seedlings in that area. This will require considerable expenditure upon materials and labour, and obviously it is better not to allow conditions favourable to the development of the trouble.

Control by Use of Poisoned Bait and Check by Furrows.

To avoid trouble from larvæ migrating from the weedy areas or breeding grounds, two methods may be employed:—

(1) If such breeding area is more or less limited in extent and migration is of a local nature, efficient control may be obtained by placing little heaps of bait around the cotton seedlings at the front of the attack and in the zone where the larvæ are active. Such an application was made when invasion into areas of young plants occurred on the State Farm. After forty-eight hours an extensive count showed that 87 per cent. of what larvæ could be found beneath the seedlings were actually dead. The attack was very effectively stopped. Attention should be paid to the source of the larvæ, and it may be wise to remove the weeds of the area and follow up with a broadcast application of poison bait. Naturally all applications of the poison-bran bait should be made in the cool of the evening so as to be fresh for the night-feeding cutworms.

(2) If the breeding area is extensive and borders on the cotton field for a considerable distance it may be found possible to draw and bait furrows which will, under favourable conditions, prevent invasion. The effective application of this method is, however, subject to severe limitations. The soil must be in a suitable condition and the furrows have to be well drawn—that is, they must present on the side to be protected a steep face of loose fine soil, surmounted, if possible, by a line of loose earth provided by the opening furrow. A furrow should be first opened with the loose earth thrown towards the area to be protected; then the return furrow should be cut into this, so as to leave the line of earth above a steep face. At least two such furrows should be drawn and baited, and no weed or earth bridges should be left in them. On the State Farm five furrows were drawn, and the first two of these were baited. The first of these collected an enormous number of larvæ, at one stage as many as 150 being counted in a single foot of furrow. Under normal conditions the first furrow would check about 70 per cent. of the migrating larvæ, and very few would reach the third furrow. However, even after a small shower of rain the larvæ could climb the face of the furrow on which the loose soil particles had become caked. After ten points of rain had fallen, considerable counts of larvæ were made in the third, fourth, and fifth furrows, and no doubt some surmounted all five furrows. It is desirable then that the first few rows of cotton in the area being protected should be watched carefully, and if necessary poisoned bait be distributed along them. After rain the furrows should be redrawn and rebaited.

Preparation of Bait.

The formula for the poison-bran bait is as follows:—25 lb. bran, 1 lb. Paris green, 1 quart molasses dissolved in 2 quarts of water, and more water as required to make a crumbly, well-moistened bait.

The first essential point to be observed in the preparation of the baits is that the Paris green be thoroughly mixed with the bran, this being done while the bran is dry. The molasses is then dissolved in water and is mixed with the bran and Paris green. Further water should be added slowly and mixed in, care being taken that the mixture does not become soggy. It must be thoroughly moistened but not taken beyond the crumbly state, otherwise it will be difficult to scatter.

For light broadcasting at least 50 lb. dry weight of bran per acre is required, while to protect rows of cotton 4½ feet apart, the bait being sprinkled along the rows at the base of the plants, 25 lb. dry weight of bran per acre may be found adequate.

How to Detect the Trouble.

Unless cutworm damage is detected at an early stage in its occurrence, considerable expense may be involved. Stress must, therefore, again be laid on the necessity for the farmer knowing the insect and its habits. Plants in certain areas may be observed to be damaged, stems and leaves being severely chewed. Sluggish pinky-grey-brown grubs up to an inch or more in size are responsible for this type of injury, and will most likely be found an inch or two down in the soil at the base of the plants. These grubs feed at night time and are the larvæ of dark dirty-grey moths which rest during the day close to the ground either amongst clods or under weeds.

When damage of the nature described has been observed, the probable source of the trouble may be looked for—namely, low growing weeds, such as pigweed or bullhead in the vicinity, whence the cutworms have emerged from eggs laid by these moths. It is not usual for cutworm moths to lay eggs on or under cotton plants, for the moisture and shade provided by low-growing weeds are apparently necessary for breeding under normal conditions.

Frequent applications of fresh poisoned bait must be made while the attack is maintained. With the dry atmospheric conditions of a Callide Valley spring, it is too much to expect bait to remain attractive for more than three days, and it is too much to expect an efficient clean-up with one application of bait.

WHAT IS AN ACRE.

5 yards by 968 yards	contains 1 acre.
10 yards by 484 yards	„ 1 acre.
20 yards by 242 yards	„ 1 acre.
40 yards by 121 yards	„ 1 acre.
80 yards by 60½ yards	„ 1 acre.
70 yards by 68 1.9 yards	„ 1 acre.
220 feet by 198 feet	„ 1 acre.
440 feet by 99 feet	„ 1 acre.
110 feet by 369 feet	„ 1 acre.
60 feet by 726 feet	„ 1 acre.
120 feet by 363 feet	„ 1 acre.
240 feet by 180½ feet	„ 1 acre.

Frog Eye Leaf Spot and Barn Spot of Tobacco.

By L. F. MANDELSON, B.Sc. Agr., Assistant Plant Pathologist.

FROG eye is quite a common disease and occurs to some extent practically wherever tobacco is grown. In most countries of temperate climate it is of little importance or else is only severe in certain seasons, whereas in tropical countries it may be responsible for considerable damage. It is apparently one of the most important leaf-spotting diseases of Nyasaland and Rhodesia, and has become increasingly prevalent in the latter country during the past few years.

In some northern districts of Queensland, such as Sarina, Mareeba, and Ingham, it is second in importance only to blue mould. In severe cases, leaves are practically covered with spots from the ground to the topmost leaf. On the other hand it is rarely observed in Southern Queensland, where it is of no economic importance.

Considerable spotting may occur in the field when environmental conditions are favourable to the development of the disease. An even more serious aspect of the trouble is the further development of spots during the curing process. Consequently in Northern Queensland this disease may considerably reduce the market value of tobacco leaf.

Cause.

Both frog eye and the barn spot, which develops during curing, are due to infection by the parasitic fungus *Cercospora nicotianae*. This organism is a weak parasite, and the damage it may cause is limited by the prevailing weather conditions and the vigour of the plant. The latter may be considerably influenced by the farmer, and hence spotting is not so severe when good farming methods are practised.

Symptoms.

In districts where the disease is not of major importance the symptoms are usually observed as roughly circular brownish spots, about half an inch in diameter, with a pale centre upon which are small black specks. (Plate 116.) These specks are masses of spores of the causal fungus. Spots of this nature are frequently found on the lower leaves of the plants. Similar spots may occur on seedlings which have been exposed to infection and have not been adequately protected with fungicides.

Where frog eye is more severe the lesions are usually smaller and more angular. The youngest spots may be observed as minute pale specks when the leaf is examined against a strong light. Later they develop as well-defined brown areas of variable shape and size. At first the spot is uniformly brown in colour. Later a white centre is formed as described above. On the average the spots are about a quarter of an inch across.

The lower and more mature leaves are most susceptible to spotting, but at times even the youngest leaves may be severely blemished, specially at the end of the season.

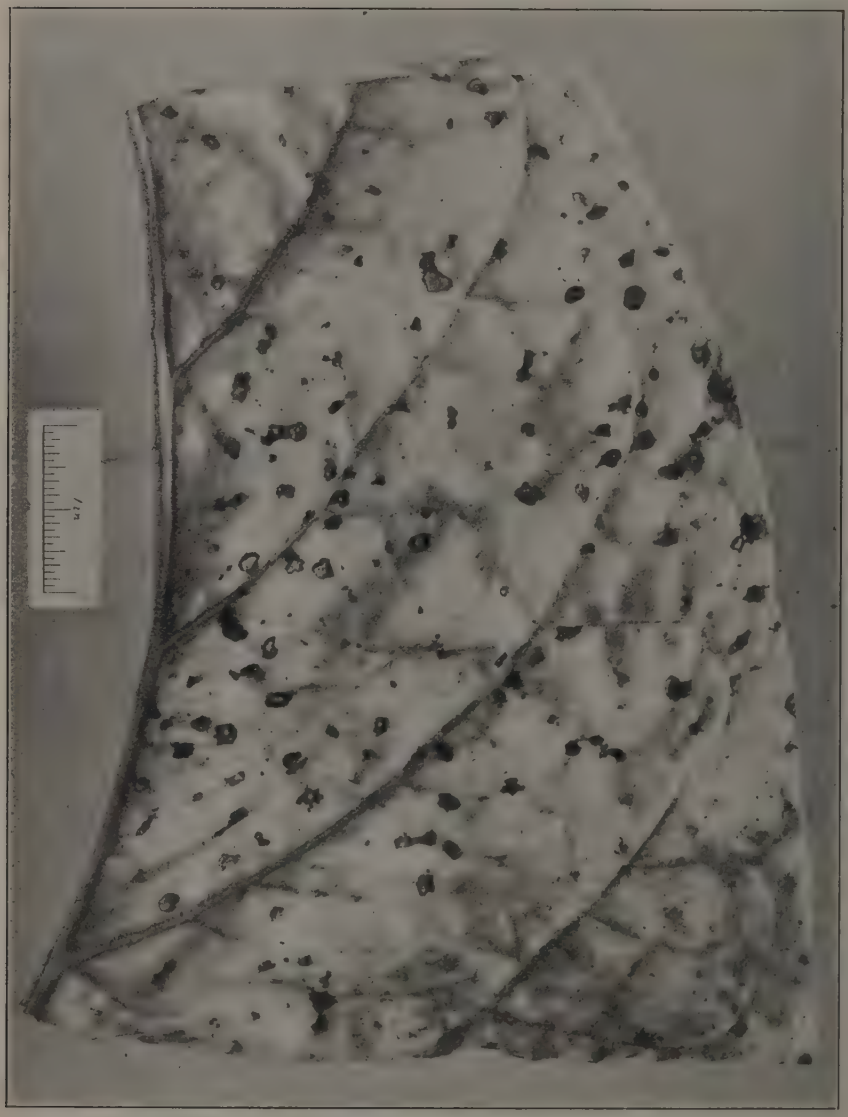

PLATE 116.—FROG EYE (*Cercospora nicotianae*).
Mature tobacco leaf showing recent infection and well-developed lesions.

The most alarming and usually the most serious aspect of the disease is the development of spots during the curing process. This phenomenon is first observed after the initial twelve hours or so when the leaf is colouring. It is most pronounced as the temperature exceeds 110° F. when the leaf is drying out. Cases have been observed where leaf has been placed in the barn practically free of blemishes and when cured contained more spots than sound normal tissue. The spots which develop in the barn are usually similar in colour although generally larger than young lesions which develop in the field—i.e., they are a uniform brown colour, vary in size from a speck to about half an inch across, and have a well-defined outline, which may be either curved or angular. The colour at times varies from brown to black.

Conditions Favouring the Disease.

Since this disease is of major importance only in the northern tobacco districts of Queensland and in other tropical tobacco growing countries, it would appear that its optimum development is associated with high temperatures and humidities. It is significant that it does not occur, or else is very rare, in the northern tobacco areas of the United States, whereas it is of sporadic importance in the more tropical southern districts. Furthermore, it is of interest to note that frog eye is of considerable importance in Rhodesia, which is in the same latitude as Queensland, and where weather conditions would be somewhat similar.

The temperature reactions of the fungus *Cercospora nicotianae* which is the cause of this disease also indicate that it would be favoured by high temperatures. It has been observed that this organism attains its greatest development at approximately 80° F. and does not grow at temperatures below approximately 45° F. or above 93° F.

Hence apparently the climate of many Queensland tobacco areas is favourable for the development of this disease. Nevertheless, when several crops in any one district are inspected, it is usually observed that the severity of the disease varies considerably from farm to farm, according to the treatment the crop has received during its growth. Seedlings which are overcrowded, are suffering from lack of nutrition or are weakened in any way are most susceptible to the disease.

Crops which grow steadily from the time they are planted, and mature in a normal period, are least affected by frog eye. On the other hand, when the growth of plants is temporarily or permanently checked their resistance to the disease is apparently lowered.

Factors which bring about this condition are irregular rainfall, especially when cultivation is not thorough, the development of various root troubles, neglect of suckering and the keeping down of weed growth, the planting of seedlings which are not vigorous, and the use of unsuitable land for tobacco growing.

Plants are weakened and consequently more susceptible to spotting when soil aeration is poor, as in seepage country, or where the soil is tenacious and in need of drainage. Furthermore, the severity of the disease is increased when plants are grown on shallow soil which has been deeply ploughed, especially when the subsoil is stirred.

Spotting is most pronounced when light rains or heavy dews frequently occur, particularly when the plants are not growing vigorously. The spores of the causal fungus are washed from frog eye spots to healthy

tissue, and readily germinate and cause infection under these conditions. It has frequently been observed in Queensland, and elsewhere, that severe spotting is associated with wet weather when the crop is maturing. Such conditions delay the ripening of the crop, predispose it to infection, and favour the development of the parasite.

The more mature the leaf tissue the more liable it is to spotting. For this reason the lower leaves are usually most affected. If leaf cannot be harvested promptly when mature because of insufficient barn space or inadequate supply of labour, the disease is more obvious than otherwise.

No varietal resistance has been observed under Queensland conditions.

Control.

As has been already indicated, unfavourable weather conditions, which naturally are beyond the control of the growers, may check the growth of tobacco plants and so predispose them to infection by this disease. Furthermore, certain weather conditions may favour the development of the parasite and so be responsible for the rapid spread of the disease through the crop.

Nevertheless, by the careful destruction of plant debris and attention to other aspects of sanitation, the original sources of infection may be greatly reduced, and by good cultural methods the effects of unfavourable weather conditions may be considerably mitigated. It is obvious, therefore, that the control of this disease largely involves good farming practices, and consequently the grower should refer to the Departmental publication "Tobacco Growing in Queensland" for detailed information on these subjects.

Some of the more important aspects of the control measures are discussed in the following paragraphs.

Field Sanitation.

Prior to commencing seed-bed operations all possible sources of infection should be eliminated. It is necessary, therefore, to entirely remove old tobacco plants from the soil within one month after harvesting the crop and destroy them.

When plants are being pulled out of the soil, the stem at times is broken, and the roots remain in the soil. Such roots may send up suckers which will be a menace to the subsequent crop. Consequently, the field should be inspected periodically, and any roots which are discovered should be hoed out.

No volunteer plants whatever should be permitted to grow on the farm after the tobacco season has terminated. The practice of keeping a few tobacco plants in the vicinity of the homestead is dangerous, and may be responsible for introducing the disease into the commercial crop.

Priming will be discussed later, but it may be mentioned here that any leaves which are removed from the growing crop should be carried from the field and carefully destroyed. They should certainly not be permitted to remain between the rows where they will be a source of infection and a menace to the growing crop.

The Seed-bed.

The soil should be friable and sufficiently fertile to produce quick-growing and robust seedlings. If the soil is not naturally fertile it should be suitably fertilized, care being taken to distribute the fertilizer thoroughly. Seedlings suffering from malnutrition, or weakened from any other cause, are most liable to infection.

Tobacco Seed and Seed Disinfection.

It is most important that only seed which has been obtained from selected healthy plants should be sown, and if seed is purchased it should only be procured from a thoroughly reliable source.

As an additional precaution seed should be surface sterilised before planting. Sterilisation, however, does not obviate the necessity of care in selecting apparently disease-free seed, since, owing to the minuteness of tobacco seed, some seed may not be thoroughly wetted by the disinfecting solution.

Either corrosive sublimate (bichloride of mercury) or silver nitrate may be used for the purpose. The seed to be sterilised may conveniently be contained in a bag of cheese-cloth or some such material.

The corrosive sublimate solution is prepared by dissolving one part by weight in 1,000 parts of water. It may be purchased in tabloid form from chemists, and one tabloid dissolved in a pint of water will make a solution of the required strength.

To prepare the silver nitrate solution 9 grains are dissolved in a pint of water.

The times of immersion are five minutes in corrosive sublimate solution or fifteen minutes in the silver nitrate solution.

After treatment, carefully wash the seed in running water or in six changes of clean water, and then spread out on clean paper and dry in the shade.

Crockery or glass, but not metal vessels, should be used for these solutions, and precautions should be taken to keep them well away from children or stock, as both chemicals are poisons.

Seed which is supplied by the Department of Agriculture and Stock is surface sterilised prior to distribution, and hence does not require any further treatment before planting.

Rate of Sowing.

Faulty sowing of seed predisposes the seedlings to many serious tobacco diseases. Since weak plants are most susceptible to frog eye, correct sowing is also an important aspect in the control of this disease.

The seed should be sown evenly and not too thickly. The majority of growers err in having far too dense a stand of seedlings. If plants are overcrowded they become weak and spindly, more prone to disease, and cannot be efficiently sprayed with fungicides.

It is much safer to sow too thinly than too thickly. When the plants are large enough it is advisable to remove the surplus seedlings and space them at least 1½ to 2 inches apart in other beds.

Application of Fungicides.

Seedlings should be sprayed with a fungicide for the control of blue mould, and such treatment will also protect the plants from frog eye infection.

Tobacco seedlings are particularly difficult to spray efficiently. Consequently special care is necessary in the manner of applying the fungicide, and a good "spreader" should be incorporated in the spray material. These aspects, as well as spray formulæ, are fully discussed under "Tobacco Diseases" in the publication "Tobacco Growing in Queensland."

Tentatively either of the following fungicides are recommended:—

Bordeaux Mixture.

Bluestone (copper sulphate)	2 lb.
Burnt (quick) lime	1 lb.
Water	50 gallons

Burgundy Mixture.

Bluestone (copper sulphate)	2 lb.
Washing soda (sodium carbonate)	2½ lb.
Water	50 gallons

The Spreader.

The addition of a spreader to a fungicide greatly increases its effectiveness, and should always be used when spraying tobacco seedlings.

Either molasses or soft soap may be used at a 1 per cent. strength—e.g., 1 lb. in 10 gallons of spray mixture. The soap should be a genuine potash soft soap in order to obtain best results.

A small portion of the original volume of water should be saved to dissolve the spreader. After the required amount of soap or molasses has been mixed well into this water, the solution should be pumped back into itself until a good lather is obtained. The spreader is then added to the main bulk of spray and stirred in well so that it is intimately mixed with it.

When to Plant Out.

The seedlings should be transplated at the earliest opportunity when they are sufficiently developed. The seedling stage is a dangerous period in the tobacco plant's career, and the sooner they are planted out the better, provided that conditions are favourable for their removal. If plants are left too long in the seed-bed they tend to become hard and woody and often are infested with nematodes. When planted out they do not make such vigorous growth as robust seedlings would under similar conditions, and consequently are more susceptible to frog eye infection.

Tobacco Soil.

It has already been stressed that vigorous growing plants are less susceptible to frog eye infection than weak seedlings. Hence it is important that the location and nature of the soil chosen for the cultivation of tobacco be suitable for its normal development. Areas should not be planted unless they have been approved by some person competent to judge tobacco soils.

Soil Treatment.

The vigour of the plants, and consequently their resistance to frog eye infection, depends largely on cultural practices.

In many districts in North Queensland where tobacco is grown the rainfall is considerable during the growing season, and drainage is frequently necessary. Lack of adequate drainage seriously affects the vigour of tobacco plants.

Shallow soils are not recommended for tobacco growing, but if such soils are used care should be taken that it is not ploughed so deeply as to bring up the subsoil. Cases have been observed where the severity of frog eye has been considerably increased by deep ploughing on shallow soils. If subsoiling is necessary it should not be carried out in the same season in which the tobacco is to be grown. Even on soils of normal depth deep ploughing is not advisable since it is apt to bury deeply what little humus is usually available.

Frequent cultivation is recommended so as to keep the soil in a loose condition in order to encourage steady growth by aerating the soil and conserving moisture. Deep cultivation late in the season, however, should be avoided since roots are damaged in this manner and growth is checked. Cultivation is not desirable after the plants are topped.

Many of Queensland's tobacco soils are very deficient in plant foods. Consequently heavy applications of fertilizers are frequently necessary to encourage normal plant development. Measures should also be taken where necessary, and for the same reason, to maintain or improve the humus content of the soil.

Priming.

In all countries where frog eye is a serious disease the most effective control measure for this trouble, and indirectly for barn spotting, has been found to be early priming.

In Rhodesia it is recommended that "three or four leaves at the base of the plant should be primed off, carried from the field and *destroyed* as soon as possible after the plants begin to make growth, so that infection is removed before the new leaves appear."

Priming is also recommended in Queensland as a usual cultural practice. It does not involve any financial sacrifice since the leaves removed are usually small and of poor texture, and would be more or less damaged by rubbing on the soil and by cultivation implements. Upon their removal, the nourishment which would have been used by them is made available for other better quality leaves higher up on the plant.

The operation does not consist of removing some spotted leaves from a few individual plants. All plants should be primed and at all times after the plants are established in the field the tips of their lowest leaves should be well above ground level.

By priming, a current of air can circulate beneath the lower leaves of the crop. The plants consequently benefit considerably, conditions are made unfavourable for the development of the fungus which is responsible for frog eye, and spotted leaves which are primary sources of infection are removed.

Priming should be regarded as a preventive measure and not one to be adopted only after the advent of the disease. It is most important, furthermore, to prime the plants early. The following quotation from a report on tobacco diseases in Florida aptly illustrates this aspect: "In 1922 frog eye was very prevalent in Gadsden County, but in fields where the leaves could be primed early the crop suffered very little damage. On the other hand, in fields where rains delayed priming frog eye caused considerable loss."

It should also be stressed that all primed leaves and any other plant debris should be carried off the field and promptly destroyed.

Harvesting.

The leaf should be harvested as soon as mature. Tissue which is over-ripe is definitely more susceptible to infection, and consequently if the leaf is permitted to age in the field spotting will be more severe than otherwise. It should be realised, however, that green leaf is worthless, and hence leaf should not be harvested before it is definitely mature when endeavouring to escape the disease in this manner.

Curing.

Variations in the usual methods of flue curing are practised in some countries with the object of mitigating barn spot development, and it is reported that a certain degree of control has been achieved thereby.

This aspect of the control of barn spot is at present under investigation.

Since these methods, however, usually involve subjecting the leaf to high temperatures prior to colouring, there is a danger of damaging the leaf thereby. Consequently these methods are not at present recommended.

A POINT IN FARM PLANNING.

It is not always possible to lay out the farm on lines which will last for all time, but if a definite plan is made in the first place it will usually be found that any subsequent alterations will be of only a minor character.

In regard to the grouping of the buildings, it is important that they be not clustered closely together, if only on account of risk of fire. Some buildings, such as the farm smithy, are a source of great risk, and if located against other buildings will lead to heavy insurance charges. The risk of loss in any case is greater when all the buildings are close to each other.

The direction of prevailing winds should be taken into account. The most dangerous winds are westerlies. Buildings, haystacks, &c., should, therefore, be located in such a way that, should one catch fire, the risk to others will be minimised. The arrangements should also be such that there will be no difficulty in making firebreaks by ploughing, planting of green trees, &c.

In arranging the buildings, attention must be given to convenient working. The haysheds, for instance, should be reasonably close to the stables. Needless to say, good drainage should be assured.—A. and P. Notes, N.S.W. Dept. Agric.

NEW DIRECTOR OF AGRICULTURE.

Mr. GIBSON'S CAREER.

The new Director of Agriculture, Mr. A. E. Gibson, was born in Victoria and educated at Dookie Agricultural College, graduating therefrom in February, 1890. He was awarded the principal agricultural prizes for that year.

After leaving Dookie College he was engaged in butter manufacturing under the Victorian Butter Bounty Scheme, and assisted in the making of the first 100 tons of butter exported to England under that scheme. A term of dairy farm management was followed by the management of a Western district sheep property for a period of four years. Later he farmed on his own account in the Maffra district, North Gippsland, where he was engaged in fruitgrowing, dairying, and general farming, and introduced to that district the practice of conserving fodder as stack silage.

PLATE 117.—MR. A. E. GIBSON.
Director of Agriculture.

Seven years afterwards he left for Queensland and joined his brother, a surveyor in the Survey Department, in field work for the purpose of obtaining first-hand information and experience in the soils, grasses, and timbers of this State; knowledge which has been a great benefit to him in connection with his agricultural work. In July, 1911, he accepted an appointment in the Department of Agriculture and Stock as Farm Foreman at Gatton Agricultural College under the late John Mahon, and continued in that capacity under Mr. H. C. Quodling, now General Manager of the Queensland Agricultural Bank, sometime Acting Principal of the College.

Mr. John Brown was appointed Principal, and during his régime Mr. Gibson was responsible for the conduct of the farm operations, including all experimental work.

He was transferred to the head office early in 1915 as Agricultural Instructor under Mr. Quodling, who was subsequently appointed Director of Agriculture.

Eventually he was appointed Senior Instructor in Agriculture at Brisbane, coincidental with the similar appointments of Mr. G. B. Brooks and Mr. N. A. R. Pollock, who were stationed in the Rockhampton and Townsville districts respectively.

In June, 1930, Mr. Gibson was appointed Government Representative, as deputy for the Director of Marketing, on the Wheat, Barley, Peanut, Arrowroot, Broom Millet, Honey, and Canary Seed Boards. During Mr. Rumball's absence in England he also acted as Government Representative on the Egg Board. In addition, he was the Government Representative on the Executive of the Council of Agriculture.

Until recently he had been discharging the duties of Acting Director of Agriculture, pending confirmation of his present appointment.

NEW AGRICULTURAL CHEMIST.

Mr. GURNEY'S CAREER.

Mr. E. H. Gurney, who has succeeded the late Mr. J. C. Brünnich as Agricultural Chemist, has had a long and notable official career. His first important appointment was as chief Assistant Chemist to Mr. F. B. Guthrie, Agricultural Chemist, Department of Agricultural, Sydney, New South Wales, from 1893-1901. During this period he made investigations of hybrid wheats for the famous wheat breeder, Mr. W. Farrar. In 1901 he joined the staff of the Queensland Agricultural College at Gatton as Science Master, and in 1908 was appointed First Assistant Chemist to the Agricultural Chemist, Mr. J. C. Brünnich, Department of Agriculture and Stock, Brisbane. In addition to his laboratory work, numerous lectures have been delivered, from time to time, by Mr. Gurney to various farmers and fruitgrowers' associations on soils and fertilizers.

In 1929 a series of addresses on animal nutrition were given by him to the pastoralists of the south-western portion of Queensland. On the retirement of Mr. J. C. Brünnich in 1931, Mr. Gurney was placed in charge of the Agricultural Laboratory, which position he held till he was appointed Agricultural Chemist on 19th July of this year. He was president of Royal Society of Queensland in 1917; and is a member of Australian Chemical Institute, of which he is president-elect for Queensland, 1933-34.

Mr. Gurney is a regular contributor to these pages, and his papers on animal nutrition and related subjects have won widespread notice.

PLATE 118.—MR. E. H. GURNEY, A.A.C.I.
Agricultural Chemist, Department of Agriculture and Stock, who has succeeded the late Mr. J. C. Brünnich.

PLATE 119.—GATTON AGRICULTURAL HIGH SCHOOL AND COLLEGE—NEW DORMITORY FOR OFFICERS.

PLATE 120.—GATTON AGRICULTURAL HIGH SCHOOL AND COLLEGE—NEW DORMITORY FOR STUDENTS (IN PROGRESS).
[Blocks by Courtesy Works Department.

THE NOOGOORA BURR (*Xanthium pungens*).

A WEED POISONOUS TO LIVESTOCK.

By C. T. WHITE, Government Botanist.

AFTER the recent rains there is sure to be a prolific growth of seedlings of the Noogoora Burr. They are poisonous to live stock, particularly pigs, calves, and chickens. The plants are, however, only poisonous when quite young and still bearing the seed leaves. They lose their toxicity when probably a few weeks old.

Description.—A robust annual weed up to 6 feet or even more under good conditions. Stems rough to the touch, due to a clothing of coarse scattered hairs. Leaves clothed, both above and below, with short, stiff bristles, lobed, the edges again lobed or toothed, 3-nerved from the base, mostly about 6 inches in diameter on the flowering shoots, but much larger on the lower part of the plant, borne on a long, stout leaf stalk. Male flowers in a few clusters along a slender terminal branchlet, soon dropping off. Female flowers in clusters in the lower part of the slender terminal flower bearing branchlet, and in clusters in the leaf axils; persistent and developing into hard, woody, spiny burrs. Burrs when ripe, brown, about 1 inch long, and densely covered with hooked spines; they contain two "seeds" (achenes), one of which usually germinates one year, the other the following.

Distribution.—A native of North America, supposed to have been introduced into Queensland with cotton seed from that country about seventy years ago.

Common Name.—Noogoora Burr is the name in universal use in Queensland and New South Wales. It is derived from the fact that Noogoora Station, Queensland, was the first place in Australia where the plant was observed. The genus *Xanthium* is of wide distribution, but finds its greatest development in North America, where the members are usually known as "cockleburrs" or clot burrs.

Botanical Name.—*Xanthium* from the Greek *Xanthos*, yellow, one or more of the species yielding a yellow hair dye; *pungens* from the Latin *pungo*, I prick or stab, referring to the prickly burrs.

Poisonous Properties.—The Noogoora Burr and other Cockleburrs are now known to be definitely poisonous to stock. The plants, however, are only poisonous in the young stage, soon becoming innocuous.

Remedies.—In a valuable publication, "Stock Poisoning Plants of the Range" (United States Department of Agriculture Bulletin 1245), C. D. Marsh, speaking of poisoning by *Xanthium* or Cockleburrs, states: "Experimental work has shown that beneficial results follow the administration of oils and fats. For this purpose linseed oil, bacon grease, or lard can be used."

Uses.—In a booklet on "Cockleburrs" (United States Department of Agriculture Circular 109), A. A. Hansen states: "A method of extracting oil from cocklebur seed has been developed, producing a valuable oil useful for paints and varnishes and as human food."

Eradication.—All efforts to eradicate the burr should be aimed at preventing seed production. The young plants, when growing thickly together, are quickly destroyed by weak arsenical sprays. In the Journal of the Council for Scientific and Industrial Research (volume 3, No. 2), Dr. Jean White-Haney has a comprehensive survey of methods of eradication. Regarding the use of arsenical sprays she states: "This mode of destruction is employed in densely infested areas. In the great majority of cases investigated, arsenic pentoxide solution of strength of ½ to 1 lb. arsenic pentoxide to 1 gallon of water was sprayed on to the plants. Arsenic pentoxide solution has been reported by all those whom I have heard have used it to be 100 per cent. successful in killing burr plants, those which were sprayed with the more dilute solution being as effectively, though more slowly, destroyed."

Botany.—Until recent years the botany of the genus *Xanthium* was in a somewhat jumbled state. A monograph published by Dr. Felix J. Widder (Fedde's Repertorium Beihefte Band XX.), in 1923 was a valuable contribution to the systematics of these plants; he recognised twenty-five distinct species and several hybrids. The Queensland plant has always been referred in the past to *Xanthium strumarium* L., a name at that time used in a very general way for several Cockleburrs. Dr. Widder states that the true *Xanthium strumarium* is a native of Europe and Western Asia. It is not known to be naturalised in Australia. Dr. Wedder being a correspondent of mine, I sent him several specimens of the Queensland plant, and he has identified it as *Xanthium pungens* Wallr.

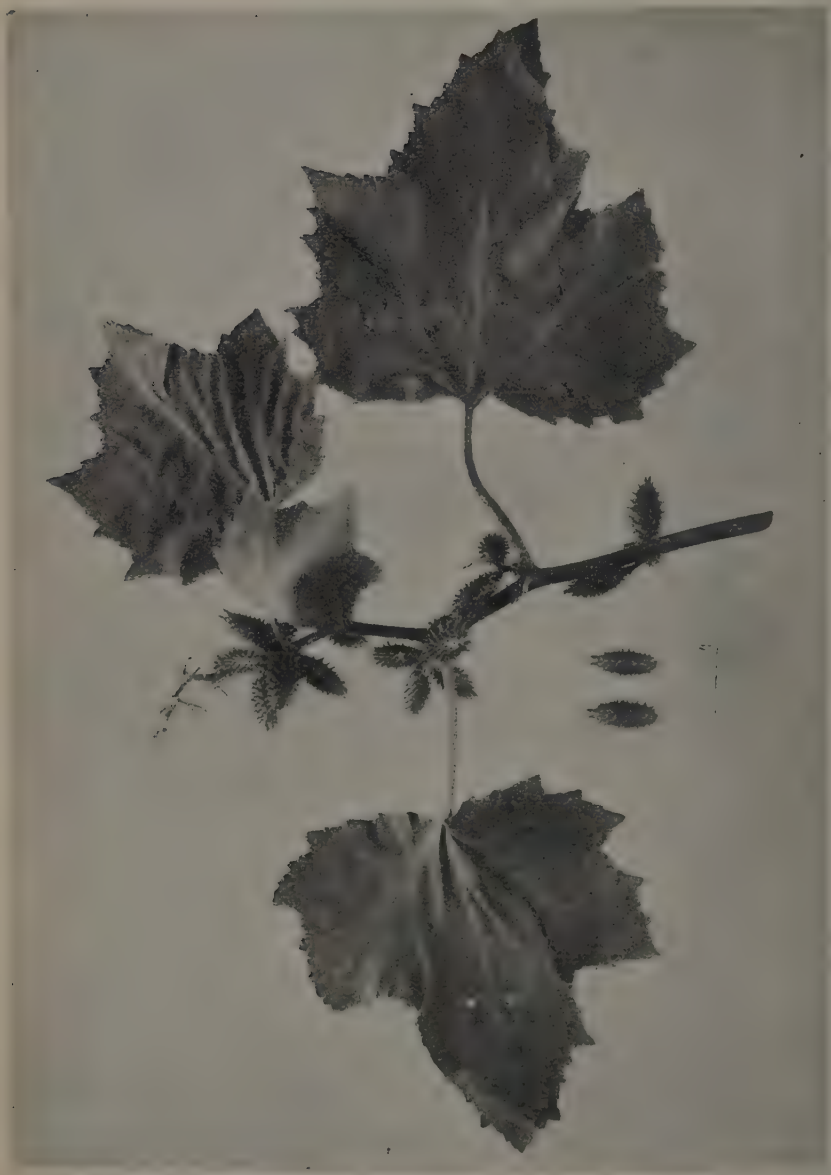

PLATE 121.—NOOGOORA BURR.
A Weed Poisonous to Live Stock.

THE QUEENSLAND NUT (*Macadamia ternifolia*).

By H. BARNES, Acting Director of Fruit Culture.

UNTIL recent years the possibility of commercialising the Queensland Nut, or to give it the name now largely recognised, the Australian Nut, was not considered feasible. Whenever mention was made of this nut, one conjured up a mental picture of a small, very hard-shelled nut which possessed a kernel that was very nice to eat, but which required the exercise of such tremendous energy to break it that it was generally considered too troublesome to bother with.

It was not until expert horticulturists and men fully qualified to express opinions of weight on such matters had drawn attention to the value and excellence of the nut by such statements as "it is the finest nut grown in the world" that we began to realise that we had at our door perhaps the foundation of what it is hoped and anticipated will before too many years have passed be a prosperous industry.

Inquiries revealed that there were many different types of Macadamia nuts, and included among them were some excellent thin-shell varieties, which could be opened with comparative ease. The difficulty, however, that the nuts did not throw true to type in subsequent generations presented itself, and adventitious means of propagation proved to be none too easy. Several propagators in this State have, however, persisted in their efforts to find an easy means of grafting the seedling trees, and considerable headway has since been made. In this work special mention might be made of the success achieved by R. Allsopp, manager of the Queensland Acclimatisation Society's gardens, Lawnton, and W. R. Petrie, on his nursery at Petrie, whilst the writer has been successful in using the method known as grafting by approach. It should, perhaps, be mentioned here that though success has been attained in getting the grafts to "take," there is still a deal of information to be gleaned, such as the effect of the operation on the constitution of the tree before definite recommendations can be made that planters should obtain only worked trees.

It must be admitted that the position at the present time, so far as recommendations as to suitable types to plant, is a difficult one, in view of the fact that the industry is as yet comparatively new and there is not much data available on which to work. For instance, analyses of the nuts of different varieties and other experiments are still inconclusive so far as determining the advantage or greater value of a particular variety over another; so that, for the present, recommendations can only be regarded from the point of view which nuts are of most value in respect of the size of the kernels. A study of the position from this angle alone appears to indicate that thin-shell and large medium shell varieties will probably be most in demand. The thin-shell nuts will probably be used entirely for table purposes, and it is likely also that a proportion of the kernels of the thicker shell types, after they have been cracked, will be used in the same way. The actual cracking of the thick-shell varieties is not likely to present any great difficulty, for a machine has been devised by a Brisbane engineer which will crack with ease a limited number of nuts in a given time. While 100 per cent. of the kernels are not delivered from this machine without blemish, the results are encouraging and the device will doubtless later be improved. The greatest difficulty at the present time is to devise a machine which will separate the kernel from the shell after the latter has been cracked.

Export Market Prospect.

So far as the export market is concerned (this may be many years ahead, but it is just as well to take the long view) the thick shell is again not likely to present an insurmountable problem, for the nuts can be cracked at home and the kernels packed in vacuum containers for shipment, so that the expense of freight on thick, heavy shells will be avoided.

Definite figures as to the area under Queensland nuts in this State are not at present available, but it is possible the acreage is between 200 and 300, and more growers are planting each year. If all that has been said regarding potential markets overseas is true, then we need not fear that the present area will fill all requirements. The writer personally has been in touch with several buyers requiring several tons a month, and according to reports from America, a big tonnage of good quality nuts can be disposed of in that country at a price returning in the vicinity of 5d. per lb. to the grower. Much has been said and written in the last few years about the financial possibilities of the industry, and some ridiculous claims are reported to have been made by individuals who would like to claim credit for the possession of a spirit of patriotism, but who in reality are imbued solely with the idea of boosting this new industry for the purpose of personal gain. It is for the purpose of bringing before growers and prospective growers, as far as possible, the

actual position of this new industry and other relevant matters, so that they may not be led into accepting any fantastic statement of interested or ill-informed people that this article is written.

Cultivation of the Nut.

Regarding the cultivation of the *Macadamia ternifolia*, it is probably quite superfluous to reiterate the fact so often mentioned previously that this tree is indigenous to the coastal districts of this State from the Dawson River south to the border and to the north-eastern portion of New South Wales. So far as is known, it has not been found growing naturally in any other country in the world. Though it is found principally in the heavy jungles (miscalled scrubs) or rain forests of our coastal districts, it is known to grow well in other good, well-drained soils in situations free from frost, and preferably sheltered from heavy winds. Too much stress cannot be laid on the importance of selecting good land and a suitable site for an orchard. Some reputed experts on the subject of Queensland Nuts advocate planting on any poor land. In refutation of this most misleading advice, however, I believe it will be sufficient if I call attention again to the fact that the Queensland Nut is only found growing in the wild state in fertile jungle soils, and it naturally follows that domesticated trees must produce the best results on similarly fertile soils.

It has been mentioned previously that there are many varieties, and that at the present time the actual value of any variety must be gauged chiefly by the size of the kernel. Varieties have not been specially classified, but are sold under the name of thin shell, medium shell, large medium shell, or thick shell.

Planting.

Seed nuts may be planted in early spring in seed-beds and covered with about 2 inches of soil. The bed should be kept constantly damp, and it is a good plan to cover it with a mulch of well-rotted stable manure, straw, &c. It has been found in practice that only about 60 per cent. of the nuts germinate, the time taken for the young plants to appear above ground varying from one to three months, according to the thickness of the shell. Soaking the nuts in water for two or three days prior to planting has been found to promote early germination. The plants should not be transplanted from the seed-bed until the following winter, the months of July and August being regarded as most suitable. In lifting the plants from the seed-bed for setting out in their permanent positions, it will be found that if the plants are 12 inches high above ground, the taproot will be about 24 inches long below the surface. Their removal may be facilitated by giving the bed a thorough soaking a few hours prior to lifting the plants, and then digging a narrow trench about 18 inches to 2 feet deep along the side of the bed a few inches from it. With the aid of a digging fork inserted at the back of the plants they can then be gently eased into the trench and lifted without excessive injury to the fibrous lateral roots or leaving behind a large portion of the tap root. Keep the roots moist at all times, either by placing them in a bucket of water or wrapping in a wet bag. It is extremely important that the roots should not be exposed to the sun or dry air any longer than is necessary. When transplanting, the holes should be dug about 2 feet in diameter. Fine top soil should be placed round the roots which should be spread out evenly in a downward direction at an angle of about 45 deg. When the hole has been three parts filled with soil, tramp it firmly round the plants and apply a gallon or so of water. The leaf area of the plants should be reduced by about two-thirds to reduce evaporation. This can be accomplished by entirely removing the lower leaves which are usually bunched together and cutting off about half of each of the remaining leaves.

Seed may be planted out in the positions the trees are to occupy permanently; but this method entails a lot of extra work watering if the weather is inclined to be dry.

The distance allowed between plants can be varied somewhat, but 25 feet is regarded as a good all round distance. This distance allows of seventy trees being planted to the acre. The average age at which the trees become reasonably productive is seven to eight years, though light crops are frequently borne at four years from putting out the young trees. Maximum production is reached in about twelve to fifteen years, when the return under natural conditions is computed at 50 to 100 lb. of nuts per tree.

Though the trees respond well to cultivation, once they become established it is not essential that this should be intense, as the suppression of weed growth in the vicinity of the plants will suffice. Experience to date has shown that a light pruning of crowded branches periodically will at least improve the size of the nuts.

The general method of raising plants has been set out above, but it is questionable whether the trouble involved by each grower raising his own plants and the twelve months' wait before they are transplanted is warranted, for it is possible to procure one year-old plants from a number of reliable nurseries at a very reasonable price.

During the summer following planting, it is advisable to shade the trees during the hottest months. It has been observed that the provision of shelter from the hot sun at this period is of great benefit to the trees, and is often the means of preventing them being burnt off at ground level.

Nuts and Bananas.

Many growers who have planted Queensland Nuts have interplanted them amongst bananas, and this practice is generally recommended. In such circumstances the cost of cultivation of the trees is practically nil, because they are automatically worked when the weeds in the bananas are being chipped and the grower also has the advantage that when the bananas are worked out the nut trees are well established and able to take care of themselves. The trees do not materially interfere with the growth of the bananas, as the latter are shallow-rooted plants, whereas the roots of the nut trees tend to go well down.

Maturity of the nuts is indicated by the outer covering or husk splitting up the side. Nuts should not be harvested prior to this development, for if they are picked green the kernels are distasteful and rapidly deteriorate.

An association, known as the Australian Nut Association, has been formed with the primary object of fostering Macadamia nut growing, and many growers have enrolled as members. The association has done much good work in the investigation of various matters pertaining to the industry. Growers are advised to offer their full co-operation to the organisation, the hon. secretary of which is Miss A. Steven, 22 O'Connell street, West End, South Brisbane.

Experimental Work.

The Department of Agriculture has undertaken a number of experiments in connection with the Macadamia. The prospects of producing saleable crops in districts away from the coast are being tested in an experiment plot in the Stanthorpe district. Some trees are growing in and around Toowoomba, but the nuts produced are almost invariably small, or very thick shelled with a small kernel. As, however, there is no record of the origin of the trees, it is not possible to arrive at definite conclusions.

At Buderim another plot has been established, in which several varieties have been planted, and results are being watched.

At St. Lucia Boys' Farm School an acre of land has been planted with nut trees and a further acre is being prepared. Here experiments covering a number of aspects have been commenced, and others are being instituted.

The Agricultural Chemist has carried out a number of analyses of different varieties of the Macadamia, and would be pleased to test and report on samples of any new varieties sent in by growers.

DO WE KEEP PACE WITH NEW DISCOVERIES?

Admitting the necessity for pressing on with the work of agricultural research, it is very obvious that the accumulation of knowledge is proceeding far faster than its conversion into every-day farm practice. This "lag" in farming practice varies, of course, with the community and the individual, but according to an American writer research is frequently from ten to thirty years ahead of the farmer.

It is inevitable that in this sense the farmer should be in some degree "behind the times," though not many, it is to be hoped, are behind to the extent mentioned. Knowledge necessarily takes some time to percolate to the point of its application; nor can one entirely blame the farmer whose instinct it is to change to a new method only when extended trials have proved its worth. Sheer conservatism, on the other hand, is losing many farmers a substantial amount of money annually. It is a doubtful distinction, after all, and by no means profitable, to be among the "diehards" in this respect.—A. and P. Notes, N.S.W. Dept. Agric.

THE PECAN NUT.

By H. BARNES, Acting Director of Fruit Culture.

THE pecan nut is closely allied to the walnut—in fact, it belongs to the same natural order (Juglandacea). It is one of the hickories, and the generally accepted botanical name is *Hicoria pecan*. It grows wild in various parts of the United States and in the territories around the Gulf of Mexico. Its cultivation in Queensland is being gradually extended, and its possibilities as a profitable tree are well worth considering. It is one of the most important nuts grown in America, and the yield about equals that of the walnut. It is excellent in quality and delicacy.

The pecan tree can be grown in this State over a wide range of localities and is not subject to injury by frost. It is found growing in various parts. Many years ago, Mr. Pentecost, of Toowoomba, planted a number of trees. A few also are found in the Maryborough district, whilst in the last few years a number of new areas have been planted up in various districts. The Acclimatisation Society of Queensland some years ago introduced a number of proved and tested varieties, which have shown promising results in their gardens at Lawnton. This Department also introduced several varieties at one time, but by far the best results to date have been obtained by Mr. E. Collins under the very equable and natural conditions of Redland Bay.

Mr. W. R. Petrie, of Petrie, has a number of fine three to four-year-old worked trees, and, in addition, has also a nursery of young trees.

The tree is also grown in various parts of the Union of South Africa, where it is looked upon as highly profitable.

Propagation.

The propagation of this tree from the seed is not difficult, and is similar to that of the walnut, except that as soon as the nuts are ripe those required for seed should be stratified in beds of slightly moist sand mixed with a little wood-ash; should they become very dry, it is advisable to soak them four or five days in water before placing them in beds to germinate. Dr. Morris, in his book on "Nut Growing," states that better results are obtained if the nuts are not entirely covered by soil, but are partly exposed to the influences of the weather, remembering, of course, that the soil is to be kept moist. A further method of assisting germination which recommends itself is to mulch the soil in which the nuts have been planted with animal manure, straw, &c., which should be dampened occasionally. This will keep the soil moist underneath, and periodical inspection will reveal when the embryo plants are ready to shift. As soon as the nuts start to show life by splitting they are planted out in nursery rows, about 3 to 4 feet apart and a foot apart in the lines. The ground should be well worked, and must be naturally fertile or made so by the addition of manure, well rotted, and worked into the soil. The rows in which the nuts stand are usually sunk to a depth of 2 to 3 inches, and, after setting out the embryo plants, around which the soil must be well pressed, a layer of ash or weak stable manure is spread in the hollowed-out rows.

When the seedling is about a foot above the ground the tap root, which is enormous, will be found to be from 2½ to 3 feet long; during the winter, when the tree is dormant, this root may be severed at about 1½ feet below the surface, and the tree allowed to remain in the ground for another year and then planted out in the orchards about 30 feet apart. Grown under favourable conditions the tree attains enormous dimensions, and specimens in existence in America are 9 feet in diameter and 100 to 170 feet high. Although a few nuts are borne after four or five years of growth, anything like a crop is not expected till the tree reaches the age of from eight to twelve years, when the yield may reach anything from one to three bushels of nuts, increasing, as the tree gets older, up to, say, twenty bushels. The pecan, like the walnut, is very long-lived, and in deep fertile soil will grow and bear for a century or so.

Soil.

It thrives best in deep fertile sandy or clayey loams, bottom lands near river-beds and on alluvial deposits. But although it favours this type of country, it has a fairly wide range of adaptability, and many of our old worn-out banana plantations on the sides of hills and mountains could be quite profitably planted up and made

to continue their sphere of usefulness instead of being allowed to remain idle. Though partial to fairly moist conditions, the soil must be well drained and the water-content always kept on the move. The tap root has the reputation of seeking water at great depths.

Planting.

In planting out, root development will be very greatly assisted by breaking up the subsoil with the aid of explosives. The use of a ¾-inch or 1-inch plug of gelignite at a depth of 2 feet 6 inches to 3 feet is recommended in the average soil. A hole is made in the ground at the site of the proposed tree with a soil auger when the soil is "dry," or if an auger is not available the hole may be jumped with a bar. The charge, with fuse and cap attached, is then lowered into the hole and the soil filled in, no tamping being required. The shattering effect of an inch plug is 7 feet laterally by 18 inches to 2 feet down. When putting in the trees the best soil should be placed in contact with the roots and well stamped throughout, except a few inches of the uppermost layer. Care must be taken that the trees are not planted too shallow. The nursery mark may even be a little below the general surface of the ground.

Grafting and Budding.

As with most other trees, the product of seedlings, however carefully selected, is variable, so that working-over of proved varieties is resorted to. Great difficulty was at first experienced in obtaining good results, but this difficulty has now been practically overcome, and with a little extra care good results are obtainable. Budwood should be taken from the previous year's growth, and H or side H method gives good results.

Grafting.

Various kinds of grafts are used, one of the most successful and popular being the "rind or bark" graft. The "whip tongue" is also largely used in top-grafting old trees, but the "strap" graft gives better results. Mr. Allsop, of the Acclimatisation Society's gardens at Lawnton, has experimented with the "slot" graft, as described by Dr. Morris in his book on "Nut Growing," and has obtained good results. The one important point is that both buds and scions for grafting are taken from wood of the previous season. A terminal bud—that is, the fruiting bud—should not be used as a scion, as, from the habit of the tree's growth, the bud immediately before the terminal takes up and continues the main vertical growth of the tree and becomes a leader for the time being.

Stocks.

The stocks on which to work selected pecans are varieties of hickories or seedling pecans. The affinity of pecans with many of the hickories is good, and the range of adaptability to various soils may be somewhat greater than that of the pecan seedling itself, although, taking all things into consideration, pecans or pecan seedlings are probably better than those on hickories.

Up to about fifty nuts to the pound is considered a fair-sized sample of pecans, although as few as twenty-five to the pound of some varieties may be selected. The tree is monoecious, as is the walnut, in its flowering habit—that is, the staminate and pistilate blossoms are borne separately upon the same tree. The staminate blossoms appear in clusters of catkins upon the last season's growth, somewhat in advance of the pistilate blossoms, which are found only at the terminals of the new branches.

The tree may be expected to thrive in most of the regions adapted to the culture of ordinary tree fruits of the temperate zones. As a rule, if left to grow at will, it does not stand up well against winds; no doubt pruning to give better scaffolding and greater stability to a certain extent will modify this defect.

Owing to the trees being planted at so great a distance apart, cultures of different sorts are carried on between them during the early period of the orchard's development.

THE PAPAW OR PAPAYA (*Carica Papaya*).

By H. BARNES, Acting Director of Fruit Culture.

THE native home of the papaw is recorded as being tropical America, although the actual part to which it is indigenous is not definitely known. The plant is easily propagated from seed, and this fact has aided its rapid dissemination throughout the tropical and, to some extent, subtropical, countries of the world. There appears to be no record of how and when it was introduced into Queensland, but it is now grown in all our coastal districts in frost-free situations. It is probably one of the most susceptible of tropical plants to frost injury, and should always be planted above this level.

The Plant, its Habit, and its Fruit.

The papaw is a giant herbaceous plant rather than a tree, attaining a height of 12 to 20 feet, and according to its natural habit develops only one stem, with no lateral branches, and surmounted by a turf of large palmate leaves borne on the end of long petioles. Its likeness to the palm has often been remarked upon. The height of the fruit from the ground, after the plant has made about three years' growth, often results in the fruit being bruised and damaged when it is being picked. This difficulty can be overcome largely by pinching out the terminal growth of the young plant when it is 2 to 3 feet high. This will cause the single stem to divide into several secondary stems, all of which will bear fruit, and which naturally will not grow so tall as in the case where the plant is allowed to grow with a single stem.

Normally, the plant is of dioecious habit with staminate and pistillate (male and female) flowers produced on different plants. The flowers are produced in the uppermost axils of the leaves, and in the case of the male tree the flowers are white and are borne on the end of long pendant racemes 2 to 3 feet in length. These flowers are sometimes of a hermaphrodite nature, and it is on this account that they are at times followed by small elongated fruit of no value. The flowers of the female tree are more yellow in colour, are larger, of a bell shape, and are subsessile.

The fruit of the papaw varies in shape according to variety from spherical to cylindrical, and when mature is of a bright yellow colour. The flavour varies somewhat in different varieties, and is also influenced by the conditions under which it is produced. Generally, however, it may be described as sweet, though at times insipid, and to some demands an acquired taste. It can, though, often be made more palatable by the addition of sugar, lemon, or orange juice, or wine. The fruit makes a splendid ingredient in the preparation of fruit salads, and is also made into excellent sauces, jams, chutneys, &c., whilst when green, after being allowed to soak to remove the milky juice and then boiled, is quite equal to vegetable marrow. Many claims are made for the wonderful medicinal qualities of the papaw. It is credited with possessing remarkable digestion promoting properties, as also are the seeds, which resemble watercress in flavour. An active principle known as Papain, which greatly resembles Pepsin in its digestive action, and is sometimes used as a substitute for the latter, is present in the milky sap of the fruit and in all parts of the plant.

Varieties.

In recent years much attention has been directed to the evolution of perfect bisexual or hermaphrodite types in an endeavour to dispense with the necessity for male trees in an orchard for the purpose of cross pollination. The late Director of Fruit Culture (Mr. G. Williams) stated in an article in the "Queensland Agricultural Journal" for December, 1931, that two bisexual varieties, the New Guinea or "Long Tom" and the Cowleyii or "New Era" introduced into the North some years ago were worthy of mention, but that the typical features had by cross-fertilization been almost eliminated. The truth that is contained in this statement is evident from a study of the fruit arriving at the markets from different districts. Modifications of these two original varieties are the most largely grown in Queensland at the present time, though the Cowleyii probably takes preference over the New Guinea type.

Planting.

It is wise for intending planters to select their own seed from large, well-formed fruit which have been allowed to thoroughly mature on the tree. The seed should be well washed in fresh water and then dried in the shade. Early spring is the best

time for sowing the seed, and the use of specially prepared seed-beds subjected to partial shade is the recommended practice. If the beds are kept well watered the young plants will appear in a short time, and when about 8 to 12 inches high may be transplanted to their permanent positions. When planting out, the foliage except the young undeveloped crowns should be removed to reduce evaporation from the plants. Here a note of caution may be sounded. If at any time during the life of the papaw plant it is necessary to remove foliage, only the leaf blade should be cut away, allowing the petiole or leaf stalk to remain on the stem. If the petiole is removed whilst green an entrance to the stem of the plant is allowed for various rot-producing fungi, whereas if it is left on the plant the latter has a chance to protect itself by the deposition of a layer of corky bark at the junction of the petiole and stem, and no open wound is left through which disease can gain an entrance.

Where young plants are grown under shade, this should be removed several days prior to transplanting, and watering should be discontinued to allow the plants to harden off, so that they will be able to get a better start when planted out. A few hours prior to digging up the plants give the bed a good soaking, so that the plants may be easily lifted without excessive injury to the roots. The plants should be taken up with a ball of earth adhering to the roots and planted in their permanent positions at about the same depth as they were growing in the seed-beds. Firm the soil well about them and water thoroughly.

In any lot of seedling plants there is always present the possibility of numerous male plants, which, as has been intimated, are unproductive. Though many methods have been advanced from time to time as guides to enable male plants to be distinguished from female plants in the seed-bed, none unfortunately have yet been put forward which can be recommended as infallible. It is, however, frequently the case that in the seed-bed a wide variation of vigour in individuals is noticeable. In practice it has been found that the stronger plants are almost invariably males; so that by weeding out these plants and leaving only the weaker specimens there is a reasonable chance of obtaining a big percentage of females. It is not suggested that by following this practice 100 per cent. females will be secured, and as a further precaution it is recommended that in planting out, two or even three plants be planted 2 or 3 inches apart in the one hole and allowed to grow. When the flowers appear the males and unnecessary females can be removed and one female plant left in each hole. About 8 feet by 8 feet is regarded as a reasonable distance apart for planting, as this enables horse cultivation to be carried on between the rows.

Soils.

Whilst the papaw is not essentially a deep-rooted plant, and, provided drainage is good, will grow well on soils which are comparatively not of great depth, it is a fairly heavy feeder, and is therefore partial to a fertile soil. If the soil is not over well supplied with plant foods, the deficiency may be made up by the addition of stable manure where available and the application of artificial manures. The Agricultural Chemist recommends the following fertilizers per acre:—1 cwt. nitrate of soda; 2 cwt. bonedust or Nauru phosphate; 1 cwt. superphosphate; 1 cwt. sulphate of potash—or 1 to 2 lb. of this mixture per tree.

Marketing

The nature of the papaw renders it a comparatively difficult fruit to market successfully without bruising where it has to be transported over long distances; consequently the first requirement is that it be given every protection when packing, at the same time keeping in view the appearance it will present when exposed for sale.

The Instructor in Fruit Packing states that before being packed the fruit should be cooled and sized. To assist in making the operation of packing easier, it is a great help to endeavour to match the various shaped papaws whilst sizing them into heaps. Four sizes should be sufficient to cover the packing of papaws for export. Sizing is easily done on a flat-topped table covered with soft bags or other suitable material. Many growers do not think it necessary to go to this trouble, failing to appreciate that the skin of the papaw is exceptionally tender, and that the slightest scratch will cause the fruit to bleed, thus damaging the appearance of the fruit.

Packing.

The best container for long-distance carriage of papaws is the tropical fruit case, 24¼ inches long by 12 inches wide by 12 inches deep, as used for bananas and pineapples. Woodwool is the most satisfactory packing. The box is prepared by

placing a layer of woodwool on the bottom of the case and around the ends and the sides. Each papaw is then wrapped in soft paper and placed in a single layer in the prepared box, using small pads of woodwool to make individual fruit firm and snug. A thin layer of woodwool is then placed over the top of the fruit, and the process is repeated until the case is full, finishing off with a layer of woodwool packing on the top. It is unwise to have the fruit projecting too far above the top of the box, but the lid of the case should press just firmly enough to keep the fruit snug and firm. Packers should avoid placing too much padding in the case. Care in matching the various shaped fruit will greatly assist in this. By using a coloured wrapper in conjunction with the woodwool a very attractive package can be placed on the market. Care in eliminating all green, over-ripe, or diseased fruit when packing is absolutely necessary to ensure safe transit and satisfaction to buyers.

Packing for Local Markets.

Growers who are near enough to their markets to be able to use motor transport have a decided advantage over those who have to send over long distances. The fruit can be left on the tree to become almost fully ripe before sending to market, and it is not necessary to pack in the same manner as when sending farther afield. Close attention should be paid to the elimination of all disease-infested or marked fruit, and sizing should also be rigidly adhered to. The Australian dump case, made in the form of a tray 18 inches long by 14½ inches wide by 8⅝ inches deep, is a good container for the local market. The fruit is packed on end in a single layer resting on a layer of woodwool or similar packing. As a protection against rubbing the bottom end of each fruit, it should be wrapped for about two-thirds of the way up in clean white or coloured paper, while each fruit is made snug and tight by pushing pads of woodwool in between each fruit. Papaws packed in this way have a very attractive display value, and sell much more readily than those carelessly placed in cases without packing, the buyer being able to appreciate the quantity and quality at a glance.

SEED MAIZE FOR SALE.

Maizegrowers are informed that the Department now has available for distribution an additional stock of selected stud seed maize of the Improved Yellow Dent variety, price 9s. per bushel, railage paid to the purchaser's nearest railway station. Supplies of all other varieties are exhausted.

Improved Yellow Dent.—A tall-growing, late-maturing variety, five to five and a-half months. The ears are cylindrical in shape, carrying sixteen to eighteen tightly packed rows. The grain is deep, wedge-shaped, of rich amber colour, with a yellow tip cap and rough, coarse dent. It is suitable for coastal districts and scrub lands where there is a good rainfall. It is capable of giving heavy yields of grain and fodder. Special strains of this seed have yielded over one hundred bushels per acre under field conditions.

As supplies are limited, the quantity available for any one applicant is restricted to not more than three bushels. All orders must be accompanied with remittance. Cheques with exchange added should be made payable to the Under Secretary, Department of Agriculture and Stock, Brisbane.

AGRICULTURAL NOTES.

By H. S. HUNTER, Agricultural Branch.

CROP PROSPECTS.

UNUSUALLY favourable seasonal conditions have been experienced throughout the early spring months, the rainfall has been well distributed over the period, and thereby providing the maximum benefit from the total registration. With the coming of warmer weather in the month of October growth of vegetation has been stimulated; spring-sown crops are making good headway, and the improved pastures are reflected in better yields from dairy herds.

Wheat.

Although wheat-sowing was a little later than usual, the crops have made good progress, and the early October rains have practically ensured a good yield, if not a record. [It is now estimated that the wheat yield will be 6,000,000 bushels—Ed.] The highest yield in the State was obtained in the 1930 season, when 5,107,161 bushels were harvested from 272,316 acres. It is estimated that the current season's acreage is considerably in excess of the area sown in 1930; and it now remains for the crops to escape damage from rust and hail, or heavy rain at harvest time. Rust has made an appearance in some of the fields, but at the time of writing weather conditions are such as to check its spread. The two minor wheat-growing areas—the Maranoa and the Dawson Valley—are experiencing the best season for many years. In the Maranoa the crops are now ripening and harvesting is near at hand.

Contrary to earlier anticipations, it now seems possible that all of the Australian States will experience a normal wheat season, and consequently the agreement to restrict exports may create a carry-over. The average quantity exported over the past three seasons was 150,000,000 bushels, and it is now learned that Australia has agreed to export not more than 105,000,000 bushels up to the end of July next, which means a reduction of 30 per cent. instead of 15 per cent. as at first stated.

As the result of the possibility of an unmarketable surplus in Australia, and the fact that world prices have fallen to low levels since the United States has commenced to subsidise the export of its surplus wheat to the East, the market prospects for the coming harvest are somewhat obscure.

There is a considerable increase in the area planted with canary seed this year, and the resultant harvest should provide a surplus, sufficient to create a safety margin to ensure of Queensland's supplying the requirements of the Commonwealth during the following season.

Maize and Dairy Fodders.

Extensive areas have been planted with maize and summer-growing dairy fodders, and the crops generally are making good headway. It is seldom that good supplies of artificial fodder can be secured in the early part of the season and with the normal summer planting yet to take place, from which the bulk of fodder is usually obtained, an excellent opportunity presents itself to conserve the early harvest for use next winter.

Potatoes and Onions.

The recent rains have caused a considerable amount of blight in potato tubers, and as imports from Southern States have practically ceased, prices have improved on the local market.

Early season's onions are commencing to come forward, but in some instances the quality has suffered, owing to the bulbs having been lifted from the soil too soon.

Cotton.

This season will witness a record sowing of cotton, with conditions at planting time most favourable for securing a good stand. In the Callide Valley, where the soil has received a thorough saturation, weeds are causing trouble, and at this stage the growers desire fine weather to enable them to cope with foreign growths. A good season would be of incalculable benefit to the growers in the Callide area, for many of them are in straitened circumstances from the effects of a series of crop failures. A further payment is to be made to cotton growers for the 1933 season's cotton at the rate of ½d. per lb. on all seed cotton received since 31st May, plus ½d. per lb. on all seed cotton received during the course of the season.

Tobacco.

Orders for tobacco seed are not so numerous as in past seasons, but this may be attributable to a great extent to the fact that many established growers have saved seed from the previous crop. This practice is not commended in cases where the previous crop was infected with serious disease. Seed originating from disease-free crops is procurable from the Department of Agriculture and Stock, price 4s. per oz. The varieties available are Hickory Pryor, Warne, Yellow Pryor, and Cash. The planting of seed-beds will be in full swing by mid-November and ploughing operations now are well forward for the coming crop. Instances may still be found where old season's plants are permitted to remain in the ground months after harvesting has been completed. By his neglect to uproot and destroy these plants the grower is providing a breeding ground for pests and diseases. Besides, failure to destroy the plants is an offence under the Diseases in Plants Acts.

Increase in Milk Supply.

As the season advances, the milk supply is mounting week by week, and the output of dairy products from the factories increasing. Now that Victoria has agreed to fall into line with the other States, an Australian stabilised price for butter should soon be an accomplished fact.

According to the Export Control Board's annual report, butter exports for the year ended 30th June last aggregated 100,546 tons, or 9,460 tons more than the previous year's figures. Cheese exports were 5,411 tons, or an increase of 2,033 tons. The average weekly price received for choicest salted butter was 86s. 6d. per cwt., compared to 104s. 6d. per cwt. during 1931-32.

PLATE 122.—DAVID DERBY.
Champion Trotting Stallion at this year's Brisbane Show; the property of Mr. D. Knox, jr.

THE DAIRY INDUSTRY.

SUPPLEMENTARY FODDER CROPS.

(Supplied by the Dairy Branch.)

THE loss of wealth to Queensland through drought and seasonal shortage cannot be accurately estimated, but there is no doubt of its immensity. If supplementary fodder crops were grown and conserved on every dairy farm drought losses would be lessened considerably.

During the spring and summer months the pasture grasses grow rapidly, and if the method of rotational grazing described previously in these notes were adopted generally there would be ample pasturage of high nutritive value in any normal season. There is then little call for supplementary fodder crops, unless the farm is overstocked.

The same thing would apply in winter, if winter-growing grasses were introduced, and provided there was sufficient rain to produce the desired growth. However, it is only within recent years that any attempt has been made to introduce certain winter-growing grasses. During winter months pasture growth is at its lowest by reason of our limited winter rainfall, consequently, a full measure of nutriment cannot be obtained by the cattle from the ordinary pasture grasses.

Most farmers engaged in dairying do not seem to realise the advantages of growing crops to supplement pastures and to tide their stock over the leaner months. Furthermore, fodder crops should and can be grown and conserved in good seasons as a form of drought insurance.

It is the duty of every farmer to prepare for the inevitably recurring dry year.

Of the fodder crops which may be grown in the dairying districts of Queensland, the following have proved to be the most satisfactory during the summer months:—Lucerne, maize, sorghum, including Sudan grass, cow peas, cow cane, pumpkins, Japanese millet, white panicum, and all foxtail millets.

Winter fodders are represented by such crops as rye, barley (preferably skinless), field peas, vetches, wheat, oats, and root crops (represented by mangels and, in some particularly favoured districts, field carrots), while rape and field cabbages have under favourable conditions been produced in certain dairying districts, chiefly in those situated on the coast. In order to supplement the available feed in dry winters some method of fodder conservation is necessary.

Methods of Conserving Fodder.

The two chief methods of conserving fodder are in the form of silage and hay. While the curing of a fodder as hay entails the drying out of sufficient moisture from the crop to ensure that no injurious fermentation or the production of objectionable moulds shall occur, the curing of a crop as silage demands that the natural moisture or juices of the crop shall be as far as possible retained. The growing of a crop of succulent fodder, and the preservation of it for an extended period in a condition palatable to stock, can be carried out by the farmer of average intelligence without previous experience in silage making, provided that the instructions which are issued by this Department are rigidly adhered to.

Crops for the Silo.

The crops commonly used for making ensilage are maize, sorghums, including Sudan grass, Japanese millet, white panicum, wheat, oats, barley, and peas. Lucerne when used alone is apt to suffer in the process of ensiling, but is valuable in combination with other fodder of a fibrous nature.

While ensilage may be regarded as a very valuable fodder during dry times, its chief value is in its succulence; and concentrates in some form or other are necessary to replace the proteins which are lost in process of fermentation during ensiling. Carbohydrates are generally increased by the changing of the starches into a more assimilable form. A very common and erroneous idea exists, in that any form of fodder used for ensiling purposes is as good as another. That is not so. Naturally such crops as maize will produce a higher quality of ensilage than that produced from Sudan grass, while a mixture of either wheat, oats, or barley with field peas is superior to that produced from such crops as rye or foxtail millets. Generally speaking, leguminous crops can only be used for silage purposes when used in combination with crops having a higher fibre content.

The cultivation of crops for silage is practically the same as if they are to be used for feeding in the green state. Harvesting is much the same, except that it is preferable to cut and bind the material if machinery is available.

For the average dairy farm, the necessary machinery is too expensive, but much might be done in the way of co-operative ownership of such machinery.

Where the maize binder is not available and the crop is sown in drills the mower may be used for cutting; but mowing is uneconomical, due to the fact that after being cut the stalks require to be bundled for loading. A side delivery mower is to be preferred for such work, if available. Where neither is procurable, hand cutting with a cane knife and placing in bundles for loading is advisable. A sledge fitted with a scythe on one side to operate as a cutter has been found serviceable in handling light maize crops.

When to Cut for Silage.

The right stage at which to harvest a crop for silage varies with the crop. Maize is harvested when the grain is in the milk stage; sorghum and Sudan grass while the grains are formed, but still in the milk stage; wheat and oats when the grain is in the milk stage, but before any sign of over-maturity of the leaf is in evidence. Sorghum, while not as good as maize for silage purposes, has the advantage of producing a satisfactory crop under soil and climatic conditions that would be unfavourable to maize. Yields of sorghum up to 20 tons to the acre have been obtained in good seasons. It is poisonous in the immature state, and cattle should not be allowed access to it prior to the flowering stage. Maize under good conditions gives just as heavy yields as sorghum, but has the disadvantage that it receives a very serious setback during dry weather with consequent decrease in yields. Sudan grass belongs to the sorghum family, but gives slightly lower yields. Like all other sorghums, it requires to be fed with due caution during its immature growth.

Wheat, oats, and Japanese millet are not as suitable for silage as maize or sorghum, although silage made from these crops is just as nutritious. The yields of these crops are not particularly high, rarely being over 9 tons an acre in their green form.

Successful silage production really consists in the expulsion of the air from the green mixture, and then its exclusion; the more complete the exclusion the more perfect is the silage. In practice exclusion is obtained by pressure—that is, by weighting the green material.

The Stack Silo.

Stack silos have generally been looked upon as being the simplest and least costly method of ensiling. The chief drawback to the stack method of ensiling is the amount of wastage through exposure to the air. The extent of the loss depends on the method of stacking adopted and the amount of pressure used in weighting the material stacked.

The stack silo is certainly a cheap method of ensiling fodder, for very little preparation is necessary, and it is well suited for cases of emergency, when a crop of maize intended for grain fails owing to dry weather.

The site of the stack should be on a naturally drained piece of ground, and handy for feeding out to the stock, and yet as close to the crop as it is possible to get it.

A pamphlet entitled "Some Notes on Silage" is available from the Department. Clear and concise directions are contained in this pamphlet for the conservation of fodder in the form of silage; while leaflets entitled "Silos and Silage" and "Weighting the Silage Stack, a probable solution of the difficulty," are also available from the same source.

Trench Silos.

The success of this class of silo depends on situation and the nature of soil in which the trench has been excavated. The best situation is along the top of a ridge, thus permitting the rapid drainage of water away from the trench. Frequently the type of soil met with under these conditions is shallow and stony or gravelly, and if it overlies a good retentive clay so much the better. The heavy basaltic soils met with over a considerable portion of the State are not, under the usual conditions, suited for trench silos. In fact, any soil which during droughty periods drys out and leaves fissures or cracks cannot be recommended.

It has been previously stated that the essential conditions governing the conservation of green material in the form of silage is the expulsion of the air contained in the material; and if air is permitted later on to come in contact with

the fodder, which by fermentation has then been changed into what we term silage, more or less decomposition will take place. Usually after a dry period heavy rains are experienced, and here again risk of damage from seepage through the fissures in the soil is incurred. The admission of water to silage brings about rapid decomposition.

Provided situation and soil are suitable, a trench silo can be effectively excavated with a plough and scoop, and it is preferable to confine the length of a trench to reasonable limits in order to obtain a proper depth. Consideration should be given to the situation that would arise were heavy rains to occur during filling operations, and for this reason alone it is desirable to limit the length of the trench silo. In all trench silos provision for some form of sump to allow drainage to be pumped during filling operations is necessary, but once filling has been completed the vertical shaft from the sump should be filled in with earth and packed tightly to exclude the air.

The sides of the trench should be kept as vertical as possible in order to facilitate the settlement of the green material during fermentation. In filling, lay the fodder in the direction of and not at right angles to the trench. Commence filling at the bottom, driving the wagons into and over the material in the process of filling, as this tends to consolidate the mass. As far as possible lay the fodder evenly, reversing the heads and butts in order to do so, while gradually extending the slope of the ramp. Keep the material well consolidated at the sides during filling operations. Continue filling until the material is at least 4 feet above the level of the sides, and finish with a pronounced camber or arch on top.

Before covering the fodder with the earth taken from the trench, it is advisable to cover with a layer of at least 1 foot in depth of green waste material, preferably a lush growth of grass. This will mat and exclude the soil from contact with the silage. To facilitate the use of the scoop, it will be found to be an advantage if a thin layer of soil is first shovelled over the covering grass. This prevents its displacement in the early part of the scooping operations. Place the earth evenly over the full extent of the trench and aim at maintaining the camber attained during filling operations. Gradually extend the covering of earth until it extends at least 4 or 5 feet above the area of the excavation. As the material sinks, it will be found necessary to replace some of the soil in order to prevent soakage of water into the trench should heavy rains occur shortly after filling.

When emptying start from one end of the trench and work towards the centre, cutting from top to bottom. Cut the silage in narrow benches, using either a broad-bladed hay knife or a well-sharpened socket-handled spade kept particularly for such purpose. To prevent damage by rain when emptying the trench, it will be necessary to provide some sort of water-proof material which can be easily placed in position and removed when required.

Pit Silo.

This silo has several features to commend it. It can, for instance, be located in a hayshed and floored over, or it can be out in the open and protected by a roof. It is advisable to raise the silo a few feet over the ground level with a concrete wall, which will increase the capacity and allow for sinkage. A point about the pit silo is that it can be easily filled with chaffed material, the equipment necessary being much less expensive than that required for an overground silo. At the same time, the cost of emptying is more, owing to extra labour being required in the process. The material in the silo should be well trodden down to exclude air, and, as the silage settles, a few minutes each day should be devoted to tramping it down to prevent access of air.

Overground Silos.

As the name implies, these silos are constructed above ground, the usual material being concrete. These silos are somewhat costly to build in the first place, but are the most economical over a period of years, the cost of upkeep being practically nil. With reasonable care a farmer would be able to construct his own silo, thus reducing the cost considerably. The Department of Agriculture and Stock has a number of moulds for use in the erection of circular reinforced concrete silos. These moulds are in three sizes—viz., 14 feet, 15 feet, and 17 feet diameter—and are loaned to farmers for silo construction free of charge, on condition that the borrower pays all transport charges on both forward and return journeys between the Department's store in Brisbane and the site where the silo is to be erected. The borrower also is required to deposit a sum of three pounds (£3) as a bond of good faith that the

moulds will be returned in good order and condition, and free from any adhering cement, as soon as possible after the job is completed, when the deposit is returned in full.

Plans and specifications of reinforced concrete silos of different sizes may be had *gratis* from the Department of Agriculture and Stock.

The fodder must be chaffed before being elevated to the silo. An ordinary chaffcutter will do for this purpose, and to which is fitted an elevator or blower. A good type of blower requiring very little power to operate is now obtainable for about £40.

The determination of which is the best system of ensilage depends on the conditions on the farm on which it is to be used, and this is a matter for the judgment of the dairy farmer concerned, who must be guided by the circumstances under which he is working.

Haymaking.

In this system of conservation, although dried considerably, the fodder retains its food value. Its palatability is increased considerably if it is fed with succulent foods. The nutritive value of hay depends on the nature and quality of material from which it is made, the changes and losses, if any, incidental to the process of curing, and the change occurring after it has been stacked.

The proper time to cut is when the plant possesses the greatest quantity of digestive nutrients, combined with palatability. In crops other than legumes, this is indicated by full flowering. Lucerne should be cut when at least 40 per cent. of flower is present, but before new growth starts from the crowns. Other legumes should be cut when the pods are well set, but not yet mature.

During the curing process, care must be taken not to lose the leaf, as this part of the plant contains the largest percentage of nutrients. To ensure that the leaf is not lost, the fodder should be raked into windrows as soon as the plant has wilted to protect the leaf from the action of sun and wind. The hay should be cocked before the leaves are dried and their property of drawing moisture from the stems destroyed. If this is done correctly a nice green sample of hay will result. During hot weather, lucerne hay should be handled only during the early portion of the day or well on towards evening.

There is less loss if the hay is stored in a hayshed, but as this is not always possible the alternative is to build haystacks. The site for the stacks should be in a position convenient both to the paddock in which the crops are grown and to the place where it is to be fed to the cattle, and on a well-drained site.

As haystacks erected as a standby in time of fodder shortage may not be required for some time, their covering to prevent damage from rain is important. The stacks may be thatched with strong thin-stemmed plants such as Sudan grass, blady grass, or other tall-growing fibrous grasses. The better method, however, is to cover the stack with sheets of corrugated iron fastened to wooden sections, which are then bolted together, forming a rainproof cover. This method is more expensive than thatching, but the long life and ease of handling outweigh this disadvantage.

Only the finer-stemmed fodder crops can be effectively converted into hay. Crops like sorghum and maize are too fibrous, and therefore can only be conserved as silage or stover. Ratoon crops of Sudan grass, however, make a satisfactory class of hay. The crops most suitable for conservation as hay are lucerne, Japanese millet, Hungarian millet, Sudan grass, wheat, oats, barley, and cow peas.

Of these fodders, by far the best is lucerne, as this crop is high in protein content. One stand will last up to seven years, and three to five cuttings a year may be obtained in suitable localities. Contrary to general opinion, this crop will grow successfully on almost any kind of soil, provided it is well drained and not over-acid. However, it prefers a deep alluvial calcareous soil for best results.

Owing to its high protein content the feeding of lucerne alone gives a rather narrow nutritive ratio, and, therefore, the practice of sowing oats with lucerne seed in certain favoured districts may be followed; and it is to be commended, for it gives a well-balanced hay at least for the first two cuttings, or until the oats dies out.

Cowpea hay is also rich in proteins, and is a good standby in cases of shortage of lucerne hay. Sudan grass and the millets mentioned are heavy yielders, and from 2 to 3 tons of hay can be expected. They take much longer in curing than lucerne, owing to their greater succulence. Care must be taken that hay is sufficiently dry before being stacked, otherwise fermentations take place, producing sufficient heat

to set up spontaneous combustion or to a lesser degree char or brown the fodder. Stacking with excess moisture due to dew or rain is also liable to produce spontaneous combustion in a stack.

In addition to ensilage and hay making as methods of provision against seasonal shortage, another method is the cultivation of crops which are more or less frost-resistant and grow well in winter. These crops are planted in middle or late autumn and make fairly fast growth during the winter. The chief crops grown for this purpose are oats, wheat, skinless barley, prairie grass, and canary seed. These crops should be sown no later than April to enable them to sufficiently develop to feed off in the middle of winter, when grass is generally at its poorest stage. Care should be taken to allow these crops to root deeply and stool out before the cattle are allowed to graze on them, otherwise the maximum benefit will not be obtained from the crop

The disadvantage of this method is that the crops grown have a very wide nutritive ratio, and there is considerable wastage, due to the large quantity of carbohydrates consumed over and above the nutritional requirements. This can be overcome by sowing the carbohydrate-rich crops, such as wheat or oats, with some type of legumes, as these are rich in proteins. This would tend to make the fodder a more balanced ration, because when it is grazed off the cattle would obtain approximately equal quantities of both legumes and cereals.

In 1925 the Department of Agriculture and Stock conducted experiments on various Queensland farms in an endeavour to find out if cereals and legumes could be grown together successfully, and very satisfactory results were obtained. As a result, the following mixtures are recommended:—

Wheat, 30 lb., and field peas or black tares, 20 lb.
Barley, 40 lb., and field peas or black tares, 20 lb.
Rye, 30 lb., and field peas or black tares, 20 lb.
Oats, 30 lb., and field peas or black tares, 20 lb.
Canary seed, 8 lb., and field peas or black tares, 10 lb.

The extent to which it is possible to supplement the pastures by growing fodder crops varies with the individual farm, but by following the principles laid down, even in part, the risk of loss from drought or seasonal shortage is considerably minimised.

THE TRENCH SILO.

MR. Alf. Johnson, of Kinleymore, writing to the Director of Agriculture, gives the following interesting account of his experience with a trench silo:—

Re your inquiry for particulars of trench silo. The soil is a very dry, crumbly, red volcanic, having been ant (white) infested to a depth of a foot or thereabout; it has been devoid of any surface herbage, but had the usual tree growth—that is, second growth, such as sally and bitter bark.

I found on opening it some four weeks ago that the top layer of soil, about a foot, placed on fodder had kept same perfectly dry, although the top of silage to about 9 inches had not cured, and was slightly musty, but from that down to about 3 inches of bottom was better fodder than when it went in, it being a mixture of old corn stalks with cob, fat hen, Bathurst burr, and pumpkin and melon vines, and summer grass, Sudan grass, and a little lucerne. You see by that I mean the good helped to flavour the inferior.

The pit is about 90 feet long by 8 feet wide by an average of 5 feet deep. I drove a 4-horse abreast team on top of it to unload, thereby tramping it down as it came in. I intend to go deeper and about the width of two horses abreast on my next attempt.

Although I just threw it out as one would hay, there was no waste, and my cows now after three weeks feed through August are at their peak in production, being built up to start off with the early spring. I have no hesitation in saying that they are producing 20 to 30 per cent. more than would have been the case if they had no inside or guts. For cheapness and easy handling, the trench or pit silo is even handier than stacks, as there is no high lifting. I still have a third left and have same sealed up.

SUMMER FODDER CROPS IN CENTRAL QUEENSLAND.

By W. R. STRAUGHAN, Instructor in Agriculture.

MOST of our annual rainfall, commencing with thunderstorms in November, occurs during the summer months, and is scantiest during spring; consequently, if stock condition is to be maintained throughout the year, it will be found necessary to take the fullest advantage of these summer rains by the cultivation of fodder crops during the wet season, and thus assure a sufficiency of feed over the leaner periods.

Feed requirements for dry periods may be provided for by grazing, green feed, ensilage, or hay crops as facilities allow and seasons permit. Fortunately, Central Queensland is particularly well favoured for the production of a great number of crops useful for such a purpose, many of which are already being successfully grown. Their usefulness requires, evidently, only a wider field of acquaintance to promote their universal establishment. The object, therefore, of these brief notes is to make their possibilities better known.

Although this information has been prepared for Central Queensland particularly, it really is applicable to the farming districts of the State as a whole.

Panicums and Millets.

This group of forage plants are very hardy and quick maturing, providing grazing often within a few weeks of sowing. With Sudan grass they form the bulk of our summer hay crops and make excellent ensilage. Added assets are their adaptability to variations of soil, ability to thrive on shallow and cheaply prepared cultivation, and the fairly ready response of second growth after harvest.

In a programme designed to maintain a continuity of green feed throughout the year, Panicum is best suited to provide the early summer quota, our climate generally providing sufficient moisture during November and occasionally October to germinate the seed and establish the crop.

When sowing for grazing only normal seeding, 10 to 12 lb. per acre, is required, but where planted for hay during the mid-summer such robust growth can generally be expected that a double rating should be applied to ensure a hay free from coarseness.

Of the different varieties Japanese Panicum—a heavy stooling, hardy, rapid grower—is probably the most suited for grazing, followed closely in preference by White Panicum. White Panicum, having a flat and solid stem, provides a good quality dust-free hay or chaff of bright appearance. It has a tendency to coarseness, however, and for this reason growers frequently give preference to Giant Panicum—a round, hollow, but fairly fine-stemmed variety.

Hungarian or Liberty Millet and French Millet also commend themselves for more general cultivation.

Sudan Grass.

Sudan grass is another valued hay and grazing crop advised for early sowing. In mid-summer, when abundant supplies of pasture are available, it will also be found admirably suited for ensilage.

Requiring a better prepared seed-bed and warmer conditions than Panicum for striking. Sudan, however, once established, will return a greater collective yield from the successive ratoon growths than these crops, four and even five ratoons per season being reasonably possible. It makes a high food valued hay when not too rankly grown and cut at the flowering stage.

Although it is grown so largely for grazing purposes and stock are permitted to graze on it in all stages of its growth, occasional and sometimes serious losses from poisoning do occur. For this reason it should be fed with caution, and on no account should stock be allowed to graze on immature growth which has become stunted through hot, dry weather. Once the crop has reached the flowering stage, it can be fed with safety.

For grazing, sow either broadcast (10 lb. per acre) or in narrow scuffler-wide drills, at the rate of 3 lb. per acre. For hay production a heavier sowing will tend to eliminate coarseness.

Sorghums.

Sorghums are regarded in two classes—saccharine and non-saccharine or grain types. The saccharine varieties, if planted during February and March, should mature in May and June, before general frost sets in, and once mature will stand

and maintain their feeding qualities through winter until the dry spring months occur. They can then be cut and fed as required, thus furthering the aim for a continuity of green feed at a time when pasturage is scarce. Heaviest yields of this crop will, of course, be made during the wetter months, when the crop should be cultivated for storing as ensilage.

As is generally known, sorghum has one disadvantageous although avoidable feature in that, when indiscriminately fed, it may cause loss of stock by hydrocyanic acid poison; therefore, feeding or grazing should be avoided during the younger stages of growth, or when a crop is recovering from a dry spell. Once mature, or ensiled, however, all risk of such loss is eliminated. An antidote for such poisoning if it should occur is a dose of about 1 pint of molasses, treacle, or even sugar, administered immediately the affects are noticeable, or it may be administered as a precaution previous to feeding.

Of the varieties, saccaline and White African appear to be the most frost resistant. Honey is the heaviest yielder, somewhat coarse, but of excellent succulence and a distinct palatability. Collier in palatability resembles Honey, has a fine stem, and yields exceptionally well. Early Amber is the earliest variety, but once mature the stem is dry and woody.

The grain Sorghums include Feterita, Red Kaffir, Dwarf Cream Kaffir, Egyptian Corn, and others. Their value is exemplified by their ability to produce grain under conditions fatal to maize. Occasional yields exceeding 100 bushels per acre have been recorded. Parrots are particularly partial to the grain and form the main deterring factor to high production. Feterita and the Kaffirs are heavy yielders of grain, early maturing, and of dual utility. They are, however, close seeded and subject to grub attacks. Dwarf Cream Kaffir's value lies in its diminutive growth allowing of its easy harvesting. Egyptian Corn is an open-headed variety, yielding good crops of hard, good-keeping grain, which is easily thrashed. It is quick maturing, but the fine, dry stems are prone to lodge under windy conditions if the grain is not harvested immediately attaining maturity.

Maize.

This crop is cultivated mainly during the rainy months for grain. When sowing for ensilage, for which it is unequalled, or green feed, it should be sown at the heavier rate of 10 to 12 lb. per acre in drills approximately 3 feet apart, allowing for the usual inter-row cultivation.

Practically all varieties are suited for these purposes, but the more robust, taller-growing sorts as Improved Yellow Dent are more eminently so.

Where a crop is planted for grain and fails in the objective originally intended for it, this can also be equally well utilised as ensilage. The best cutting stage for ensilage is when the grain becomes glazed, but it may be grazed or cut for green feed at any period of its growth.

Cowpeas.

This legume is not extensively grown in our central district for feed, difficulty being experienced in inducing cattle to graze it green, in harvesting, and in converting it into hay. Where other leguminous fodders are not cultivated, however, it should be persisted with, for when wilted stock will eat it readily enough, and it also greatly improves the feeding value of ensilage when mixed with other crops.

Cowpeas may be sown separately or conjointly with other fodders such as maize, sorghums, and Sudan grass, &c.; but, contrary to several opinions, this method does not materially assist harvesting, but greatly improves the general balance of the ration.

The usual rates of seeding are 10 to 12 lb. per acre in drills 3 feet apart or 1 to 1½ bushels broadcasted. When sown with other crops this rating should be from a-half to one-third these quantities, the accompanying crop being correspondingly reduced.

Of the varieties, Black is of a procumbent or trailing habit, but is probably the heaviest yielding. Poona and Clay are erect growing and more easily harvested.

Peanuts.

These are another legume, and although grown principally for the nut, is fast becoming recognised as an excellent fodder crop.

For hay, peanuts should be harvested when the pods have formed, but before the plant commences to die down. They will need to be harvested in the usual method by hand and dried, preferably in cocks.

Seeding should be at the usual rate of 20 lb. of kernels per acre in 3-feet drills.

Care should be taken not to over feed stock or pigs with peanuts, the excess of oil deleteriously affecting the resultant product.

Elephant Grass.

A drought-resistant fodder of fair food value, providing frequent cuttings or grazing during dry times. The leaf is fairly readily eaten by stock and luxuriantly produced. The stem is woody and valueless, and precaution against its development must be taken. The crop is propagated by cuttings.

Cow Cane.

Cow cane is similarly propagated and of a hardy nature. The stem contains a high percentage of sugar and is of a high food value. The large Javanese varieties are most serviceable.

Sunflowers.

Sunflowers are cultivated in several countries for ensilage making. In Central Queensland, small areas are mainly grown for seed, the Giant Russian type being preferred. Sow in drills 3 to 4 feet apart and 1 foot between plants.

Soy Beans.

Although soy beans grew fairly well under Central Queensland conditions, they did not appear to be appreciated by stock.

In conclusion, it is desired to point out that Lucerne, queen of all fodders, has been, on consideration, omitted from this brief address, time precluding the justice its importance demands.

The advantages of such a crop are too well understood to need stressing, suffice it to add that, given good drainage and an adequate supply of underground water, a stand can be maintained for five to six years by efficient cultivation.

PLATE 123.—FARAAIN MERCURY (imp.).
Champion Pony Stallion at this year's Brisbane Show; the property of Mr. J. M. Newman.

REDUCING THE CONTAMINATION OF MILK AND CREAM.

By O. St. J. KENT.

ONE of the most important problems a dairyman has to face, from day to day, is the production of milk and cream that will retain a high standard of quality when delivered to a factory or to the consuming public. In the hot summer weather, such as we are now beginning to experience, the problem becomes an acute one, on account of the conditions being just suitable for the quick development in milk of many kinds of microbes.

During the course of its production, milk passes through a long series of utensils each of which adds its quota of microbes, and these little organisms constitute the most serious form of contamination with which we have to deal. Milk is, of course, subject to other forms of contamination as we will see later. It is necessary to know, just where and how these little microbes get into milk, before we can consider means for reducing their numbers. I propose, therefore, to run through each stage of milk and cream production and discuss the contamination that is likely to be encountered.

Health of Cow.

Let us start first of all with the cow itself. The first essential is that the cow should be free from disease. Unhealthy animals are a menace to the rest of the herd and milk from them will upset the quality of all the milk if mixed with it. The question of disease should not be dallied with, and the services of departmental officers should be availed of at every opportunity.

It may be of interest to dairymen to know that the interior of the udder of even the healthiest cow always contributes a few hundred microbes to every teaspoonful of milk produced. Microbes invade the udder by means of teat canal and may find their way into the milk reservoir. For this reason it is often advisable to reject the first few streams of milk. This rejected milk should be drawn into a separate utensil and should not be squirted on to the floor. This procedure of rejecting the fore milk has the further merit of indicating whether the cow is suffering from any udder trouble, such as mammitis, and so enables the farmer to avoid infection of the remainder of the herd by milking the affected cows last.

External Contamination.

The contamination of milk from within the udder is negligible compared with that occurring from external sources. Milk and cream are often contaminated as a result of particles of dirt, hairs, and other extraneous material falling from the body of the cow into the milk bucket. The only way to prevent this is to see that the animals come into the milking shed in a clean condition. Much improvement can be effected in this direction by keeping the yards in the immediate vicinity of the milking sheds clean and tidy. In any case, the udder and flangs of the cows should be wiped with a clean damp cloth just before milking, and the application of a little disinfectant solution—such as potassium permanganate—will help to reduce contamination from this source.

The Milker.

A point that is not often stressed sufficiently is that the milker may be an important factor in contaminating the milk supply. Milking is often looked upon as a dirty job, and one finds some milkers putting on dirty overalls to protect their ordinary working clothes instead of putting on clean overalls or a clean apron to protect the milk from contamination. Clean hands and dry milking are essentials in clean milk production, provided the udder of the cow has been previously cleansed and the teats softened with a little vaseline. The milker should always keep in mind that he is preparing human food, and that by applying the cleanest possible methods he will do much to enhance the favour of this food in the minds of the consuming public.

The Utensils.

The utensils in and about the milking sheds constitute a very serious source of milk contamination. Experiments have shown over and over again that utensils contribute more microbes to milk than any other source. Buckets, cans, strainers, coolers, and separators all come under the heading of utensils. The use of any of these which are badly cracked, dented, rusted, or in bad state of repair generally, is unwise. Rough surfaces and crevices form excellent hiding places for microbes, and render the vessels difficult to clean and sterilise, so that they are a distinct menace to the quality of your milk and cream.

Rusty utensils may contaminate milk in a different way. The iron in the form of rust is dissolved fairly easily by the acids which exist in milk or cream, and when in solution has been shown to have a serious effect on the quality of butter and cheese manufactured from the milk and cream containing it.

Contamination from utensils can be reduced very considerably by cleaning and scalding or sterilizing them properly. It is not only necessary to clean as much of the milk out of the utensils as possible, but it is of equal importance to see that the vessel becomes thoroughly dry after cleansing. The reason for this is that no matter how thoroughly a cleansing job is done, there will always remain sufficient food to nourish millions of microbes. It is impossible to remove all traces of milk, but it is possible to completely remove all the water which is essential for the growth of microbes. Remember then that complete drying of utensils is just as essential as thorough cleansing.

In washing vessels that have contained milk, it is always advisable that cold or luke warm water should first be used for rinsing before boiling water is added for sterilizing purposes. There is a satisfactory explanation for such advice. Milk contains a substance called albumin, which is very similar to the albumin of the white of an egg. On heating it coagulates just as the white of an egg coagulates. If in cleansing, boiling water is added directly to the milk remnants in the utensils, the albumin becomes coagulated and deposits as a thin film on the interior of the vessel. Such a film grows in thickness from day to day if the same procedure is carried out, and the vessel provides a serious source of contamination. Rinse first with luke warm water and then use plenty of boiling water to which a little soda may be added if necessary, and dry as quickly as possible. The practice of placing utensils out in the open fresh air on a clean rack, away from dust, is a good one. The air circulation will quickly bring about evaporation of traces of water that remain. On no account use cloth for drying the utensils. Buckets and cans should be easy to clean and sterilize provided they are in good order. The simpler the design the better for cleansing and sterilizing.

Strainers.

Most dairies have a strainer through which the milk is passed before entering the cans. Strainers may be a help to the dairyman provided that they are kept clean, and that the cotton wads or straining cloths are changed frequently. Straining cloths are very dangerous to milk quality if they are not washed, boiled, and dried daily. Cotton wads are safer because they are discarded as soon as they have been used once. The dairy farmer should not over estimate the power of his strainer. It certainly prevents large particles of dirt, hairs, and other substances from entering the can, but it has very little influence on the microbe population of the milk. The size of the microbes is such that they can easily pass through the pores of the straining cloth or cotton wad. If thorough cleanliness were observed throughout there would be little need for straining.

The Separator.

The separator is often a great source of contamination of cream. Milk that is perfectly good may turn out a bad cream if passed through a dirty separator. The separator should be taken apart each time it is used and the parts washed thoroughly, and quickly dried. I have stressed the drying again, because there is nothing so objectionable as an enclosed vessel containing decomposed milk products.

It seems hard to believe that there are some dairymen who will use separators that have not been cleaned from the previous day's use, yet such cases are from time to time reported. The same man would not, perhaps, think of sitting down to a meal with plates, knives, and forks that have been left unwashed since the last meal. There is no excuse for dirty methods in dairying. Even the poorest of dairymen can afford to cultivate clean habits, and one of the most important of these is to keep the separator clean.

Milking Machines.

Milking machines are somewhat like separators. They may be either a blessing or a curse according to the fashion in which they are handled. Every milking machine has parts which are difficult to keep in a satisfactory condition, and these must be particularly carefully watched. Among these is the teat-cup assembly, with its metallic and rubber parts. There are essentially two methods of keeping these parts clean—viz., the destruction of microbes by heating them in water and the other by filling them with a solution which prevents the growth of microbes in them.

The heating process simply involves placing the teat-cup assembly, after preliminary cleansing, into a common wash boiler (or similar vessel) provided with a false-perforted bottom. Sufficient water is added to cover them and the temperature is raised to 180 deg. F. for ten minutes. The parts should then be hung up in such a manner that the tubes and teat cups will drain.

A method which has also been found satisfactory is to immerse the parts in a saturated solution of common salt to which is added at regular intervals a small amount of chlorine. A leaflet on the use and care of milking machines is available from the Department of Agriculture and Stock, and should be studied by all dairymen using machines.

So far, general methods of cleanliness with utensils have been stressed, along with the necessity of complete drying after sterilization.

The Cooling of Milk Products.

The next important weapon we have at our command for reducing contamination of milk products is that of cooling. Too much cannot be said for the benefits to be derived from keeping milk and cream cool. The microbes which give most trouble to dairymen are those which grow best at high temperatures. Gassiness, yeastiness, and bad flavours and aromas in milk and cream, very often come from these products when they have not been cooled. Various types of cooling and aerating apparatus are available to dairymen, but whatever device is used, see to it that it is maintained in a clean condition. The handling of milk on its way to the factory, or during delivery to the public, calls for the greatest attention to cleanliness and cooling devices. It should be protected from the sun by suitable coverings, and should always be stored in the coolest places.

Contamination from other Sources.

Milk and cream may become contaminated from sources other than microbes. All milk products readily absorb flavours from the surrounding atmosphere, so that occasionally we come across absorbed flavours such as oily, disinfectant, kerosene, and many others. It is generally easy to track these down to their source and prevent them from occurring. Food flavours and weed flavours present a more difficult problem. Feeds which are known to cause very noticeable flavours in milk should be fed as soon after milking as possible, so as to give the undersirable flavour every opportunity of disappearing.

In conclusion, I would like to state very briefly the necessary points for efficient reduction of contamination by microbes:—

(*a*) The animal must be healthy;

(*b*) Strict cleanliness, with sterilization and immediate drying of utensils;

(*c*) Prompt cooling.

Look after these few points and the quality of milk and cream will look after itself.

THE PLOUGH AND THE COW.

Many dairy farmers erred in their methods of management in that they allowed good cultivation land to grow pasture, said Mr. A. J. Dorsman, of Broke, N.S.W., at the recent annual conference of the Agricultural Bureau of New South Wales. He was convinced that cultivation was essential and that hand feeding, not only in the winter, but all the year round, was worth considering. It was not a difficult matter to estimate the requirements of a herd for any given period and provide for them. Saccaline sorghum gave, say, 8 tons per acre, and lucerne, say, 3 tons—an average of 5½ tons per acre. If each cow received 40 lb. per day (30 lb. greenstuff and 10 lb. dry), which was the ration Mr. Dorsman had fed with success, then with the abovementioned yields 1 acre of cultivation was required to feed one cow for 308 days.

Storage of the fodder was, of course, necessary, continued Mr. Dorsman. The Department had tried to educate farmers in the use of silos and had assisted in their construction. Many man were prevented from erecting silos by the capital outlay, but this was small when considered in relation to the value of the farm and the life of the silo. A silo of 100 tons, a hayshed, an elevator, chaffcutter, and engine could be erected for £400, and would give security against conditions such as those which had obtained in the Hunter Valley for the past eighteen months, and would add value to the farm in addition to the value of the capital outlay.

FAT LAMBS.

By J. L. HODGE, Instructor in Sheep and Wool.

THAT Queensland fails to produce her quota of fat lambs in proportion to her sister States is a fact, and nevertheless to be regretted. Geographically, climatically, and pastorally there is no reason for it. That we can produce lambs equal to the Southern States is undoubted. The top pens at our recent Royal National Show were fit to compete anywhere. One reason given for the neglect of this branch of the sheep industry is the pronounced rise in merino wool values six or seven years ago. Many farmers growing fat lambs foolishly disposed of their crossbred ewes and went in for merino wool production. We have in this State large areas of land eminently suited to the business, if it is undertaken in conjunction with cultivation. I do not recommend anyone to start fat lamb production on natural grasses only. Any success achieved under these circumstances is in the nature of a fluke, and over a period of years disappointment must follow.

The Fat Lamb Follows the Plough.

A good slogan for this branch of the sheep industry would be "The fat lamb follows the plough." The wheat farmer should certainly seize the opportunity offering in fat lambs to add to his returns, and, at the same time, save himself no small amount in cultivation costs. Wheat is a splendid sheep fodder, likewise barley and oats.

Lucerne, than which there is no better sheep feed, should not be neglected. The plant will do well on any well-drained flat where there is sufficient rainfall and the frosts are not too severe. Artificial grasses deserve every consideration by way of pasture improvement, and this is especially so in the case of a winter grass. *Phalaris tuberosa* (a species of Canary grass) could be sown in the autumn and with a successful strike make an excellent winter grass.

The Lamb Required.

With regard to breeds, one difficulty we in Queensland have to contend with is the difficulty in procuring the right type of crossbred ewe. It therefore becomes necessary to breed the future mothers of the lamb-raising flock. With this object in view, the farmer would be well advised to secure the boldest and strongest possible type of merino. Those ewes culled on the stations for broadness of fibre are best suited for the purpose, having size and constitution. These should be mated with one of the English long-woolled rams, and for preference, and taking everything into consideration, I should choose the Romney Marsh. The ewe lambs in the resultant drop should be saved as the future breeders.

On this half Merino-Romney Marsh cross it is advisable to put a Downs or short-wool English ram. Southdowns, Leicesters, Border Leicesters, and Dorset Horns are all to be recommended under certain conditions: and of these I would advise the farmer to use the Dorset Horn on account of the fact that he, like the Merino, will work at any season of the year. This is of importance where the farmer is concerned, as it may be necessary in some seasons to have the ewes dropping for a specific purpose at a certain time.

The progeny of the Dorset Horn ram from the crossbred Merino-Romney Marsh ewe gives a very shapely lamb, early maturing, and a good doer. The wool from the ewe recommended, Merino-Romney Marsh, is not to be despised, the cross being a good one; but it should always be remembered that the fat lamb is of the first importance, the wool in this branch of the industry being a secondary consideration.

It does not follow that, because I have here recommended a certain line of breeding that I have anything against the other English breeds mentioned. The Southdown produces an excellent lamb, especially on rich pastures, and both the Leicesters are first class in their own particular spheres; but some choice has to be made, and I have selected the Dorset Horn mainly on account of the fact that he will work at any season of the year. This does not apply in the cases of some of the other breeds mentioned.

Points in Flock Management.

At time of mating the breeding ewes should not be too fat, or a poor lambing may result. They should be strong and vigorous. The rams should be in good condition. To have the ewes in the condition mentioned, grass land is necessary and short feeding periods only should be allowed on the crops. After lambing nothing is too good in the way of feed for the ewes and lambs.

The fat lamb must receive no check in his development, and should be landed for slaughter straight off the teat. Bred as recommended, the lambs should be ready for slaughter and export at from four to five months old. Extraordinary weights are not looked for in the lamb trade, and as long as a lamb is really fat, and a sucker of 33 lb. weight is quite heavy enough. The greatest care should be exercised in marking the lambs. Avoid all dirty yards, and, if convenient, erect temporary yards in the paddock into which the ewes and lambs are to be let go. After the operation and treatment with an approved antiseptic dressing, drop the lambs gently on to grass if possible.

Lambs for the fat lamb trade should be marked when a fortnight to a month old. The whole secret to success with fat lambs is in early maturity. They must never suffer a check from birth to the block, and it is essential that they carry that bloom which nothing but mother's milk can give. Fat lambs should be marketed as they come to maturity. A half-truck now and then when ready. This, of course, applies to local consumption. When the object of the grower is the export trade, it is necessary in most cases to consign the whole drop. Real sucker lambs properly fat should always command a good price. Many young sheep up to two tooth are sold as lamb, but these never bring the price of the real sucker.

Market Values.

It is too much to say that early fat lambs should net from 5d. to 6d. per lb., plus skin values. Taking the typical lamb at 33 lb. dressed, this gives a return at 5d. per lb. of 13s. 9d., plus, say, 2s. for the skin, or 15s. 9d. per head. The ewes' fleece under ordinary market conditions should return at least 5s. This gives a total gross return of £1 0s. 9d. per head. The drop, too, taking ordinary care, yarding the ewes and rams occasionally at night, should be a heavy one. Ninety per cent. is not too high a figure to reckon on.

Where can the farmer get a better return for his money than this, especially when consideration is given to the fact that the sheep have done his crops good? The breeder would be well advised not to run too great a number. A smaller flock properly bred and looked after will give a better return proportionately than a flock consisting of too great a number to be properly handled and fed on the property.

No Fear of Over-production.

There is no fear of over-production in Queensland for years to come, and should that day arrive, the export trade offers every inducement. In this connection it must be remembered that only the best are worth while. The export of so-called fat lambs has done the trade no little harm.

Upon written notice the Brisbane Abattoir is now prepared to handle consignments of fat lambs on grower's account.

As indicating the type of lamb required for the trade, I quote the following from the Brisbane Fat Stock report under date 4th September, 1933:—

"*Lambs.*—Only 180 lambs were penned, the bulk of these being fair to good trade quality station lambs, with only one small draft of good trade quality cross-bred lambs. These latter realised from 6d. to 6½d. per lb., whilst the station lambs generally sold from 4½d. to 5d."

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the Journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

PRODUCTION RECORDING.

List of cows and heifers officially tested by officers of the Department of Agriculture and Stock which have qualified for entry into the Advanced Register of the Herd Book of the Australian Illawarra Shorthorn Society and the Jersey Cattle Society, production charts for which were compiled for the month of September, 1933 (273 days period unless otherwise stated):—

Name of Cow.	Owner.	Milk Production.	Butter Fat.	Sire.
		Lb.	Lb.	
AUSTRALIAN ILLAWARRA SHORTHORNS.				
Mature Cow (over 5 Years), Standard 350 Lb.				
Gentle 2nd of Blacklands	H. D. Giles, Biggenden	9,165·3	401·856	Sir Hugh of Hillview
Rosenthal Hope 9th	S. Mitchell, Warwick	8,094·5	359·283	Sunshine of Rosenthal
Senior, 3 Years Old (over 3½ Years), Standard 290 Lb.				
Millstream Lucy 24th	W. J. Barnes, Cedar Grove	8,275·98	362·102	Whittier of Thornleigh
Kyabram Curly	A. H. E. Black, Kumbia	8,779·8	301·205	Ledger of Greyleigh
Junior, 3 Years Old (under 3½ Years), Standard 270 Lb.				
Model 2nd of Alfavale (365 days)	W. H. Thompson, Nanango	13,234·55	597·726	Reward of Fairfield
Senior, 2 Years Old (over 2¼ Years), Standard 250 Lb.				
Evelyn of Alfavale (365 days)	W. H Thompson, Nanango	14,050·1	546·063	Reward of Fairfield
Lady Gentle 2nd of Blacklands	A. Pickels, Wondai	8,413·3	361·023	Sultan 2nd of Blacklands
Red Rose of Trevor Hill	A. E. Vohland, Aubigny	9,092·9	359·9	Prince of Braemar
Blacklands Florrie VIII.	W. L. Burnett, Brookfield	6,953·55	278·372	Red Prince of Blacklands
Junior, 2 Years Old (under 2¼ Years), Standard 230 Lb.				
Kyabram Gentle	A. H. E. Black, Kumbia	7,952·55	291·097	Ledger of Greyleigh
Dualwon Picture 3rd	B. J. Nothling, Witta	6,190·85	242·672	Monarch of Dualwon
JERSEY.				
Mature Cow (over 5 Years), Standard 350 Lb.				
Brownfern of Oakview	F. J. Cox, Imbil	9,382·15	430·581	Acacia Crusader
Senior, 3 Years Old (over 3½ Years), Standard 290 Lb.				
Nan III of Woodlands (226 days)	D. R. Hutton, Cunningham	6,290·47	294·853	Carnation Golden Duke
Junior, 3 Years Old (under 3½ Years), Standard 270 Lb.				
Lyndhurst Marella (365 days)	J. B. Keys, Gowrie Little Plains	11,224·87	610·791	Mercedes Noble King of Ogilvie
Junior, 2 Years Old (under 2¼ Years), Standard 230 Lb.				
Meram Fair Lady	F. Maurer, Darra	5,536·3	296·707	Retford Remus
Jersey Maid of Inverlaw	R. J. Crawford, Inverlaw	5,547·1	294·479	Bruce of Inverlaw

Answers to Correspondents.

BOTANY.

Replies selected from the outgoing mail of the Government Botanist, Mr. Cyril T. White, F.L.S.

Rough Poppy; Indigo.

B.S. (Callide Valley)—

The Poppy is *Papaver hybridum*, the "Rough Poppy," a common European weed, naturalised in most warm temperate countries. It is moderately common in Queensland, though not a serious pest. It has not come under suspicion, so far as we know, as a poisonous plant, but probably stock never eat it, or at least eat it to any extent. The symptoms of poppy poisoning are given as excitement, shown by continual movement, by pawing of the soil, increased respiration, and more rapid pulse. In his book on "Plants Poisonous to Live Stock," Dr. H. C. Long says that "this is followed by stoppage of the digestive functions, sometimes a little swelling of the eyelids, and coma, one affected animal appearing to sleep while standing, remaining motionless, and if forced to move walking in an unsteady manner. Finally, the animal falls, and if a fatal result is likely (which is unusual) it remains stretched on the ground; respiration becomes slower, the temperature falls, and after a few convulsive movements death occurs owing to asphyxia."

The other plant forwarded is *Swainsona oroboides*, a species of Indigo or Darling Pea. So far as we know, no feeding tests have been carried out with this particular species. If, as you say, this particular species of Indigo is common on your property, we will consult with other officers of the Department regarding carrying out feeding tests with it.

Hexham Scent.

C.H.R., Dallarnil—

The specimen is *Melilotus parviflora*, the Melilot or Hexham Scent. This plant was boomed some years ago under the name of King Island Melilot. On sandy soils, and places generally where lucerne and the better class clovers will not thrive, it has some value, especially for fattening, but our experience with it in Queensland has been that stock do not take readily to it. As you suspected, it imparts an unpleasant odour to the milk and cream of dairy cattle which have fed on it. The Hexham Scent is common as a naturalised weed in Queensland during the late spring and early summer months, but dies off on the approach of the really hot weather.

Solanum Torvum.

J.W.M. (Ingham)—

The plant is *Solanum torvum*. It is a pest in places, but does not grow so thickly as Wild Tobacco. It has not been proved to be poisonous to stock, but these Solanums are often suspected, because a fair number of them contain Solanine.

Candle Nut.

H.T.B. (Kairi, N.Q.)—

The nuts are the common Candle Nut, *Aleurites moluccana*, a tree widely spread over Queensland, New Guinea, the Moluccas, and the islands of the Pacific. the nuts are commonly eaten by people without any ill-effects whatever, but occasionally people are made violently ill by eating them, severe vomiting and gastritis being symptoms. We do not know the reason for this. Probably it is when the nuts are slightly rancid. The nuts contain a drying oil with properties similar to linseed oil. The tree is closely allied to the tree producing the Tung Oil of commerce. In parts of the Pacific the nuts are strung together and burnt like a candle, hence the local name. They give forth a certain amount of flame with a great deal of sooty smoke. It has been thought at times that the nuts would have some value on account of the oil they contain, but inquiries so far made have not shown them to have any commercial demand.

Patterson's Curse, Roly Poly, *Gaura parviflora*.

S.C. (Pittsworth)—

1. *Echium plantaginium*, Blue Weed. A native of southern Europe, now naturalised and a great curse in some of the southern States, particularly in New South Wales and South Australia. In New South Wales it is most frequently known as Patterson's Curse, in South Australia as Salvation Jane.
2. *Bassia quinquecuspis*, a species of Bindey-eye or "Roly Poly." It is very closely allied to the Galvanised Burr. It is a pest in some localities, but does not seem to spread to quite the same extent as Galvanised Burr.
3. *Gaura parviflora*, a native of North America. It has been naturalised about Pittsworth for some years, but does not seem to spread to any appreciable extent. We have not known a common name applied to the plant. It is not known to possess any poisonous or harmful properties.

Fat Hen, Bugle, Prickly Lettuce, Pepper Cress, and Red Natal Grass.

P.J.D. (Grandchester)—Your specimens have been determined as follows:—

1. *Chenopodium album*, Fat Hen. Not known to possess any poisonous or harmful properties. Sometimes stock eat these types of plant when they are drying off. When green and succulent they do not seem to be palatable to them.
2. *Ajuga australis*, Australian Bugle. Not know to be poisonous or harmful in any way.
3. *Lactuca scariola*, Prickly Lettuce. This plant has a bad reputation, but so far as our observations go we have never seen stock eat it to a sufficient extent to cause trouble.
4. *Lepidium ruderale*, Pepper Cress. Generally speaking, this plant is freely eaten by stock. It taints milk and cream rather badly.
5. *Rhynchelytrum roseum*, Red Natal Grass. This grass is a very common farm weed, particularly in parts of Coastal Queensland. Farmers have found that it makes quite good "chop-chop" for working horses, especially mixed with better class fodder.

Eucalyptus Oil.

E.W.D. (Goovigen)—

The correct name of the Scented Gum Tree is *Eucalyptus maculata* var. *citriodora*. It has a wide distribution in Queensland, from the Burrum River in the south to Herberton in the north. The extraction of the oil has been rather an erratic industry in Queensland, and we do not know at the present time if any distillation plants are actually working. You could probably obtain this information from the Forestry Department. If you thought of erecting a still for the extraction of the oil, it would be advisable for you to write to the Curator, Technological Museum, Harris street, Sydney, inquiring for the present market prospects of the oil and also for a copy of Bulletin No. 4, "A Guide to the Extraction of Eucalyptus Oil in the Field," price 2s. We recommend you to do this, for the Technological Museum is the centre for all research into Eucalyptus and other industrial oils in Australia.

Tiger Pear—Trefoil.

"AGRICULTURIST" (Toowoomba)—

The Tiger Pear is *Opuntia aurantiaca*. It is very different from and a very much fiercer looking plant than the ordinary prickly-pear. It is generally a much-branched, spreading plant, mostly less than a foot high. The joints are very easily detachable and much narrower than those of the ordinary pear. Sometimes they are more or less rounded, particularly towards the base, and are very spiny. The flowers are similar to those of the ordinary pear, but somewhat smaller. The fruit is purplish-red, and usually bears a number of long spines in addition to the ordinary little spicules of pear fruits. The specimen of trefoil forwarded represents *Medicago orbicularis*, a native of the Mediterranean region, naturalised in Queensland and New South Wales. It is, of course, nothing like so abundant as the common Burr Trefoil, which is *Medicago denticulata*.

Caustic Creeper.

C.C.B. (Longreach)—

From the symptoms described by you there seems little doubt that the animals have been poisoned by caustic creeper (*Euphorbia Drummondii*), for they are exactly those attributed to poisoning by this plant by most practical stockowners. Feeding tests with sheep and horses in New South Wales have, so far as we know, always given negative results, and, based on this, some people have described the plant as a good fodder. On several occasions in New South Wales the plant has given a positive reaction for the presence of a prussic-acid-yielding glucoside, but repeated tests with Queensland material have always given negative results. However, the symptoms attributed in Queensland to *Euphorbia Drummondii* poisoning are certainly not those of prussic acid poisoning. Dr. D. A. Herbert, when Government Botanist of Western Australia, produced the peculiar swellings on the head and neck by feeding rats on *Euphorbia Drummondii*. In South Africa, *Tribulus terrestris*, the Caltrops, a very common burr weed in Queensland with a yellow flower, sometimes known as Bull's Heads and other names, produces a similar disease, in which the ears and head of the affected sheep swell, and when pierced the swelling exudes a fluid. It has been recently found that small quantities of this fluid injected into white mice subcutaneously kills these animals within half an hour when exposed to the sun's rays. A preliminary report on the work, which has just been published in "Nature" for July, 1933, by Dr. C. Rimington and J. I. Quin, states that the disease of "tribulosis" or "yellow thick head" is due to the passage into the blood stream of the plant porphyrin, phylloerythrin, derived ultimately from ingested chlorophyll. Possibly a similar explanation is to be given for poisoning by *Euphorbia*, but of this we cannot be sure. In this particular case the greatest effect would be in hot, sunny weather, and no doubt the condition of the sheep would have an effect also. Certain sheep are much more liable than others.

Use of Stock Licks.

J.R.Y. (Eulo)—

The findings of the Agricultural Chemist and the Government Botanist with regard to the samples of fodder are given below. You will readily understand from the general tone of the observations made that they apply to conditions ruling on your property when the samples were collected.

Of course, under your present conditions, no lick is required at all, and there will probably be no necessity for it until the feed has definitely gone off. In a general way, it may be taken that licks are used to supplement deficiencies in pastures, and waters; and possibly for some special alteration in the animal fed, although this would not be likely. For drought conditions, when the value of proper licks is most in evidence, special provision should be made in the constitution of the lick, such, for instance, as the wise and economical addition of a protein. It may be fairly stated that in nearly all cases where a lick is required at all, phosphoric acid is the deficiency. Therefore, either Nauru phosphate or sterilised bone meal should be prescribed. Both contain phosphoric acid, but the bone meal contains a protein as well. Sterilised bone meal should always be used, except for the fact that it is a good deal dearer to purchase and there is not enough of it to fill the demand. You will understand from this that Nauru phosphate, therefore, takes its place of necessity as it were. Practically the same conditions would apply for scrub or hard winter feeding as apply under drought conditions, but there may be some local reason for varying the ingredients. For instance, on hard scrub (Wilga predominating) it may be necessary to add more laxative in the shape of Epsom salts.

We have endeavoured to give you a brief outline of the general use of licks and the necessity for the use of some ingredient, or the cutting out of another as occasion demands. Now follows a lick prescribed for general purposes and based mainly on the findings of the Agricultural Chemist. It is to be thoroughly understood that the ingredients are to be varied according to seasonal conditions. We have already warned you against the use of too much salt when ewes are in lamb, especially if a protein is contained in the lick. Have on hand, then, and mix as occasion demands—Sterilised bone meal or Nauru phosphate, 40 parts; salt, butcher's quality, 40 parts; sulphate of iron, 5 parts; Epsom salts, 5 parts; linseed meal or some other good meal, 10 parts. When thought practicable, sufficient molasses may be used to bind the whole.

Cotton Grass, Jerusalem Thorn, Corkwood.

L.T. (Eulo)—

1. *Cymbopogon exaltatus*, a tall grass. Members of the genus Cymbopogon are commonly known in Queensland as Cotton Grasses. As a general rule they do not possess much fodder value.

2. *Parkinsonia aculeata*, Jerusalem Thorn. Supposed to be a native of tropical America, but now much planted or naturalised in many warm countries. It is a very hardy tree, much planted in western and northern Queensland as an ornamental. In some places it has run out, though we do not think it has become a serious pest.

3. The botanical name of the Corkwood of the West is *Erythrina vespertilio*, the Batswing Coral Tree. This tree is characterised by bearing bright salmon-red flowers. The seeds are borne in pods, the actual seeds themselves being bright red in colour.

Button Clover.

J.W.S. (Pittsworth)—

Your specimen is *Medicago orbicularis*, the Button Clover or Button Trefoil, a plant very closely allied to the ordinary Burr Trefoil (*Medicago denticulata*), but nothing like so common. It is not often seen in Queensland, but occurs more frequently, we think, in New South Wales. The plant is undoubtedly a good fodder, but in its green and luscious state is apt to bloat stock. Generally speaking, however, stock prefer these Medicagos when they are slightly wilted or dying off. Even when the plants die the pods are excellent forage for stock. The plant is an annual and dies out at the approach of hot weather. It does not stand up to dry weather very well, but has been cultivated under irrigation in New South Wales, and is said to have proved itself a useful fodder plant.

Wild Tobacco.

T.K. (Springsure)—

The ordinary Wild Tobacco of Western Queensland and New South Wales, *Nicotiana suaveolens*, contains nicotine. This alkaloid is generally regarded as one of the most violent poisons known. Some chemical work carried out by the late Dr. J. M. Petrie showed that enough nicotine is contained in one half pound of the green leaf to poison an ordinary sized sheep.

The other plants mentioned—Bindey-eye, Fat Hen, Wild Carrot, and Mustard—are not known to contain any poisonous properties. If there are any plants that you suspect, or of which you have no knowledge, it would be as well to send us small specimens for identification. If you number each specimen and retain a duplicate similarly numbered, names will be returned corresponding to numbers.

Slimy Cream.

Inquirer—The Dairy Branch advises as follows:—

Apparently you have bacterial contamination which gives rise to your trouble. The organisms responsible for it are of the ropey milk group, which are found in utensils with which the milk or cream comes in contact, more especially if the utensils are not in good condition. Utensils that are rusted, pitted, or have open seams harbour micro-organisms and should not be used. To overcome the trouble, all utensils that come in contact with the milk and cream should be thoroughly cleansed by first washing in tepid water and then in a hot solution of washing soda, after which they should be sterilized, by the use of steam or by immersion in boiling water. All buckets, strainers, coolers, washing up tanks, and scrubbing brushes used in the dairy should be included. This trouble occurs from day to day, and unless careful attention is given to cleansing and sterilization of all utensils that come in contact with the milk and cream, it will continue. Cows should be prevented from having access to stagnant water. Milk from cows suffering from any form of udder derangement should be rejected.

General Notes.

Staff Changes and Appointments.

Executive Council approval has been given to the appointment of Mr. A. E. Gibson, Senior Instructor in Agriculture, as Director of Agriculture, Department of Agriculture and Stock. Following on the above appointment, the transfer of Senior Instructors in Agriculture, as hereunder, has been approved:—

G. B. Brooks, from Brisbane to Rockhampton;

C. S. Clydesdale, from Rockhampton to Townsville; and

N. A. R. Pollock, from Townsville to Toowoomba.

Mr. T. E. Tuck, Inspector of Slaughter-houses, Coolangatta, has been appointed also an Inspector under the Dairy Produce Acts.

Constables H. Wacker (Cooran) and A. L. McLeay (Silkwood) have been appointed also Inspectors under the Slaughtering Act.

For the purposes of the control of banana pests and diseases, the following have been appointed Honorary Inspectors under the Diseases in Plants Acts in the districts specified:—F. D. Schmidt (Beenleigh), A. W. T. Petty (Ormeau), F. C. Ludcke (Eagleby), F. Stern (Carbrook), W. Benfer (Beenleigh), E. Fischer (Maroochy River), and E. Burke (Springbrook).

Mr. A. Hossack, Inspector of Dairies, who will take up duty at Laidley shortly, has been appointed also an Inspector under the Stock and Slaughtering Acts.

Mr. W. C. Woodhouse, District Inspector of Stock at Maryborough, has been appointed also an Inspector of Dairies.

Mr. E. T. Gale, Manager of Naleoombie Station, Springsure, has been appointed an Honorary Ranger under the Animals and Birds Acts.

Mr. W. E. Black, Ranger under the Animals and Birds Acts at Mackay, has been appointed also an Honorary Ranger under the Native Plants Protection Act.

The Officer in Charge of Police at Alma-den has been appointed also an Acting Inspector of Stock and Inspector of Brands.

Constable R. E. P. Willis, of Birdsville, has been appointed also an Inspector of Brands.

The Officer in Charge of Police, Pittsworth, has been appointed also an Acting Inspector of Stock.

Constable H. J. Watts, Carmila, has been appointed also an Inspector under the Slaughtering Act.

Fruit Fly Prevention, a Timely Prohibition.

A new regulation has been issued under the Diseases in Plants Acts, which provides that the occupier or owner of an orchard shall not permit fruit, whether diseased or not, to lie on the ground. If the orchard is in the Stanthorpe district, the owner shall place any diseased fruit in a pit not less than 6 feet long by 5 feet wide by 20 feet deep (or such lesser size as may be approved by an Inspector) which is provided with an insect proof cover with a movable panel therein. Such pit shall be kept closed at all times, except when the panel is open for the purpose of placing fruit in it. If the orchard is elsewhere than in the Stanthorpe area, diseased fruit shall be destroyed by boiling or other method approved by an Inspector. The above should prove an effective means of controlling the fruit-fly infestation in the Stanthorpe area.

Egg Pool Board.

Executive approval has been given to the issue of an Order in Council under the Primary Producers' Organisation and Marketing Acts, giving notice of intention to extend the duration of the Egg Pool from 1st January, 1934, to the 31st December, 1938. Not less than 10 per cent. of the growers of eggs owning fifty or more domesticated fowls may forward a petition, to be lodged on or before the 20th November, 1933, for a poll on the question as to whether or not the functions of the Egg Pool should be continued.

Nominations will also be received, until the 20th November next, for election for one year from 1st January, 1934, as Growers' Representatives on the Egg Board.

Rural Topics.

Care of the Working Horse

Most derangements of the digestive organs of horses are due to errors in diet, and a good and regular system of feeding will do more than anything else to prevent trouble of this kind. The following rules for feeding are generally accepted as correct:—

1. Water before feeding, and not for at least an hour after.
2. Feed in small quantities, and often.
3. Do not work hard immediately after a full feed.
4. Never give a horse food to which it is not accustomed in large quantities.

If the above rules are followed, and care taken to ensure that only sound, good food is fed, very little trouble will be experienced.

Export Butter Restriction—A New Zealand Viewpoint.

Thus the "New Zealand Farmer":—The conversational stress about the quota question has eased very considerably since last month's notes were made, and we are all very much cooler under the collar. It will be remembered that when the Dairy Produce Board first announced its desperate resistance to the proposed limitation of export of New Zealand butter and cheese to Britain, there were insistent declarations that a further fall in price, amounting to ruination, would inevitably result if that attitude were persisted in. The leaders of the dairy industry, however, firmly held that the London talk was merely designed to scare the New Zealand producers into accepting the quantity restrictions. Fortunately, a state of complete panic was not created in this Dominion.

"Did you notice," said one influential dairy director, "how quickly the tone changed as soon as it became definitely realised that New Zealand and Australia (so far as the producers were concerned) were both determined to rest on the terms of the Ottawa agreement?".

One had noticed it, of course. On 9th April the bears had got New Zealand butter down to 65s. to 67s., Danish at that time being quoted at 88s. to 90s. A few weeks of almost dreadful uncertainty followed, whilst the controversy continued. And then, on 9th June, New Zealand finest salted was quoted at 82s. to 83s. (with 1s. to 2s. extra for unsalted), whilst Danish was fetching 92s. to 94s.

"And," continued this authority (if there is such a thing as an authority on the mysterious movements of the markets), "the most singular thing about the business is that the disparity between Danish and New Zealand prices has been reduced from 20s. to 10s.—10s. per cwt. in favour of New Zealand butter, the lowest margin of difference I have seen for a long time."

"But do you suggest," I asked, "that the speculators are the principals in these suggestions, threats, and price variations?"

"Well," was the compassionate reply, "what do you think?"

* * * * * * *

I could venture no definite opinion. The welter of conflicting opinion had reduced me in some degree to a state of mental confusion. It was only in March that a message from a leading Tooley street house emphatically stated: "The only cure for the present demoralisation of the values of butter is immediate restriction; otherwise chaotic conditions will ensue." Cable messages were hotly contending that the saturation point had been reached; the butter glut was a national nightmare. But unrestricted production went on; increased shipments were forwarded. The figures for ten months up to 31st May, 1933, showed that New Zealand had graded the enormous total of 123,660 tons of butter, an increase of 22,572 tons (or 22.33 per cent.) over the total for the corresponding period last season. And yet, early in May, a spectacular rise in the prices of both butter and cheese took place. Now the newspaper headlines sparkle with: "A General Uplift," "Everything Rising," "Brighter Prospects," "Optimism in Trade." During the latter months of the Coates Administration the then Prime Minister seemed to have a monopoly of that comforting assurance that we were "turning the corner," but everybody seems to be doing it now.

Large Whites—A Heavy Litter.

In the endeavour to create Ton Litter records many breeders were keenly interested, and spent considerable time and effort in pushing their pigs on to early maturity.

As an instance, T. M. Noble's (Victoria) first ton litter consisted of ten pigs, being by Finchley Bar None (imp.) from Finchley Promise 11th, a daughter of the imported Dalmeny Justice. This litter reached the ton in 23 weeks 4 days, but no record was kept of the food consumed. The second and record litter from Mr. Noble's stud consisted of twelve pigs sired by Aldenham Bugler (imp.) from Finchley Maple, a daughter of an imported sow. The litter consisted of five sows and seven boars, six of which were shown as barrows. They were weaned at nine weeks, and every two weeks thereafter were weighed under official supervision. Except for a fortnight, at weaning time, the pigs were always in the open, being born under a straw stack, and all had a good run on grass until within a fortnight of completing the test.

Food consumed from the time they were six weeks old till they reached the ton consisted of 300 lb. of gristed barley, 2,580 lb. gristed wheat, 12,360 lb. skim milk. The cost of the grain was £7 4s. 8d. and the skim milk, taken at ½d. per gallon, £2 11s. 6d., total £9 16s. 2d. While consuming the above feed, the pigs put on 1,416 lb. live weight, which is equal to 944 lb. dressed weight, at a cost of 2.49d. per lb. without allowing for the grass. As the ruling price at the time was 4½d. per lb., they showed a fair margin of profit. One boar and one sow from this litter were exhibited at Melbourne Show, 1931, the boar winning in a strong class, and the sow taking second place in her class. Following are the weights at the times weighed:—

At 10 weeks	837 lb.
At 12 weeks	996 lb.
At 14 weeks	1,260 lb.
At 16 weeks	1,605 lb.
At 18 weeks	1,900 lb.
At 18 weeks 6 days	2,092 lb.
At 19 weeks 5 days	2,253 lb.

It is of interest to note that the sire of this litter, Aldenham Bugler (imp.), is a very large pig, his length from between ears to butt of tail being 6 feet 3 inches, girth 6 feet. These measurements were taken when he was in good working condition.

The Best Pasture for Dairy Stock.

The ideal pasture should contain an admixture of grasses and clovers. A leguminous content is important in any pasture—it is essential in dairy pastures. Legumes serve a second useful purpose in Australian grasslands—namely, they increase the soil fertility. A profuse growth of pasture legumes, such as that usually associated with a dense cover of well-manured subterranean clover, builds up soil condition so that the habitat is made more conducive to the growth of high-grade perennial pasture plants.

The ideal dairy pasture is one where high-production perennial grasses and clovers are dominant. Climatic, soil, and economic factors often make it difficult or impossible to maintain this ideal pasture type in Australia, often because suitable perennial clovers are not yet forthcoming. In parts of temperate Australia subterranean clover offers an outstanding example of an annual legume which serves, to all intents and purposes, the function of a perennial.

Good strains of perennial rye grass, true *Phalaris tuberosa*, and improved strains of cocksfoot, are outstanding grasses of a perennial nature which are being used successfully on dairy pastures in many parts of Australia.—From Mr. William Davies' report on the dairy pastures of Australia. Mr. Davies (of the Aberystwyth Plant Breeding Station, Wales) recently spent twelve months in Australia on pasture investigational work.

A Sagacious Cow.

A cow owned by Mr. E. Hopping, a dairyman, of Ryde (near Sydney), showed remarkable intelligence and motherly instinct during the week. It had been turned out at Liverpool for about a month, and in the meantime calved. Last week it was taken back to Ryde by motor truck, while the calf was left behind. Within a couple of days it disappeared from the dairy, and the loss was advertised by the owner, who later received word from Liverpool that the cow was outside his property. In order to reach its destination the cow swam the Parramatta River and travelled almost direct to Liverpool in less than thirty-six hours.—"S.M. Herald."

Facts for the Beginner in Poultry Raising.

In a recent address on the poultry industry, the Poultry Expert of the Department of Agriculture drew attention to some facts which are commended to the notice of those considering taking up poultry farming as a livelihood.

It should not be thought, pointed out the speaker, that poultry farming is a simple occupation which may be taken up when everything else has failed, and it must be realised that among the main essentials for success are sufficient capital to provide proper equipment, an aptitude for the work, keen observation, and infinite capacity for details, and the realisation that it involves working early and late practically seven days per week, particularly during the half of the year when the chickens are being raised.

Cost of Establishing a Farm.—The cost of establishing a poultry farm is often under-estimated by those entering the industry, with the result that many invest a few hundred pounds of hard-earned savings in a farm, struggle along for a year or so, and then find that they have undertaken a hopeless task; hence the reason for numerous farms being on the market. To put the matter of cost of working up a farm in a nutshell, it may be stated that the expenditure will amount to at least £1 for each layer, exclusive of providing a residence, which means that to establish a farm carrying 1,000 layers would cost £1,000, plus a dwelling. This amount would cover the purchase of 5 acres of land, the materials for poultry buildings, breeding stock or chickens to commence, sundry tools and appliances, and living expenses (30s. per week) for two years while the flock was being built up. It will be noted that no allowance is made for labour, it being assumed that the farmer would erect his own buildings and runs. This expenditure would only provide bare essentials, but is based on erecting buildings, which, while not being elaborate, would be a lasting asset.

It may be contended that many of the most successful farms of to-day were started on a very small capital, which is quite true, but in such cases the farmer had other means of earning a living while the farm was being built up, and it may have taken a number of years to reach the point where the farm was self-supporting. The position to-day of the majority of people taking up poultry farming is that they have no employment, so that the amount of capital available has to cover the cost of building up the farm and also living expenses for two years while increasing the flocks. The question may be raised as to why the farm could not be stocked in one year so as to obtain a quicker return. This, however, is not practicable, because it is not possible to buy laying stock at a price which would return a profit, and to attempt to rear sufficient chickens in one year to stock a farm would involve an outlay of twice as much in buildings and equipment as would be necessary to work it up in two years.

Reduced Returns in Recent Years.—While poultry farming is, perhaps, still one of the best paying small industries, the returns during the past couple of years have been adversely affected in common with all primary products, while the fact that many hundreds of people have taken up poultry farming during that time has also tended to bring down prices. As a matter of fact, the time has arrived when a much greater increase in production of eggs would mean that saturation point would be reached, notwithstanding the fact that there has been an enormous increase in the number of eggs exported from New South Wales, amounting to a total of 6,000,000 dozen last year.

The period over which export can be carried on is limited, and our population is not large enough to consume many more eggs than are produced at present. The position is also accentuated by the influx of eggs from other States, due to the better market prices ruling in Sydney. To relieve the local market of the surplus production it is necessary to commence exporting so early that a definite loss is incurred on all eggs despatched during the first couple of months of the exporting season, and it is essential that eggs be shipped away a couple of months later than is safe from the point of view of covering expenses. Were it not for organised marketing under the control of the Egg Marketing Board it would not be possible to carry on export operations on such an extensive scale, and the returns to the poultry farmer would be considerably less than at present.

The loss sustained on early and late exports has to be made up by profits during the middle of the season and the penny per dozen pool contribution made by poultry farmers. It, therefore, means that unless something can be done to stimulate local consumption of eggs, or other markets can be found overseas, which is not likely at present, there cannot be much more extension of the industry without lower prices to the producer, and when it is pointed out that the return per hen at the present time is only just half what it was in normal times it will be realised that the industry could not stand any further reduction. On last year's

returns a well-managed farm, carrying a flock of 1,000 layers, would only produce an income of £250, out of which would have to be deducted any interest on capital, rates and taxes, &c., thus the poultry farmer does not receive much to compensate him for long hours and the capital invested.—A. and P. Notes, N.S.W., Department of Agriculture.

How to Keep Cream Cool.

The first step to choicest cream is to reduce the risk of infection by absolute cleanliness at every point. The second is to prevent such organisms as have gained access from multiplying to sufficient numbers to cause trouble. The only way to do this is to cool the cream as much and as soon as possible.

In a climate such as ours, this is one of our biggest troubles. In the absence of water being laid on to the separating room, any of the small water-bag coolers, to cool the cream straight from the separator, are very efficacious, as every degree we bring the cream below 80 degrees Fahr., will have a retarding effect on the bacterial development, and in many cases (in relation to weed taints, &c.) the aeration will improve the flavour. If a cooler is not available a lot can be done by standing the cream cans in cold water, or putting wet bags round them, but it must always be remembered that fresh water is advisable each day, and the bags should be changed each day and allowed to dry. The cream should be stirred with a tinned metal stirrer two or three times each day, and not be mixed until each lot of cream is cool. Finally, the cream should be delivered to the factory daily, if possible.

Boiled down, the production of a first-class article means:—(1) Thorough and systematic cleanliness; (2) keeping the temperature of the cream as low as possible: (3) delivering the cream to the factory as soon as possible. Many dairymen, after taking as much care as possible on the farm, allow the product to become heated in transit to the factory, either by not having a well-shaded stand or, when they do the carting themselves, by not taking the trouble to keep the cans covered (by, say, clean wet bags). This neglect may very often be fatal.

How Accidents are Caused.

Experience shows that some of the most prolific causes for accidents are projecting set-screws from collars or wheels on revolving shafts.

In connection with farm machinery, the following points should be noted:—An open gear is never justified, and even a partly open gear is a source of danger. There should be no exposed shaft ends, and a flat board up against them is a simple and cheap protection. In some countries, under compensation laws, all shafting less than 6 feet 6 inches from the ground or floor must be protected.

Remember that a plain shaft revolving can be a very dangerous matter. We have seen a lad killed while passing under a revolving shaft. His coat caught, and he was swung around it at fearful speed.

Note also the pulleys should be guarded. You can get caught in the spokes of a plain pulley or may have a tool in your hand and have your hand drawn into the spokes. A great many accidents are due to the handling of belting while the machinery is in motion. An inexperienced man may put on dressing on a belt the wrong way or may try to slip on the belt while the pulleys are running and get his hand drawn in.

Circular saws are also dangerous, but are now far better protected than they used to be, but there should always be care taken in handling any power saw. A common cause of accident with circular saws is that of a man using his hand to clear from the blade a small cutting. In using a lathe a man may also use his hand to clear the tool point. Many fingers have been lost through this lack of care.

All machines should have guards to prevent chips flying. In using the emery wheel, the man who has seen an accident due to the work getting between the wheel and the tool rest, will take care in future. Yet he may have had his eye badly injured by a flying particle of the wheel, and still grind in future without the safe precaution of putting on a pair of goggles. It is a wise plan to have a pair of goggles hanging beside the wheel at all times, so that there is no excuse to risk the eyesight.

Many accidents are due to poor light, and a good light is essential where a machine is in use. You have heard of men losing an eye from a burr flying off the head of the chisel or anvil tool. Why not remove this burr, or mushroom top, on all chisels and anvil tools by grinding.

It is a good policy to see that your machines are so guarded that accidents, as far as possible, may be prevented. It pays in the elimination of risk—both for yourself and for those whom you employ. Better safe than sorry.—"Blacksmith and Wheelwright."

Summer Cultivation.

During the spring and early summer the soil of the orchard should be kept free of weeds and the surface loose. For this purpose it is a very common practice to make frequent use of orchard cultivators.

The cultivator certainly covers the area rapidly and is useful in quickly checking evaporation by breaking up a crust formed after rain, but there are objections to its too frequent use (observes a departmental pamphlet). The surface soil becomes too fine, which prevents subsequent rain from freely percolating through it, and thus much of the moisture flows away or is evaporated instead of soaking in, and if much flowing occurs surface soil is also carried away. The fine soil also becomes easily caked even by small falls of rain, and the mulch is, therefore, easily destroyed, and in showery weather requires very frequent renewal. Constant use of the cltivator also forms a sole pan; thus as the season progresses the mulch becomes more shallow and, consequently, less lasting, while the sole pan also prevents free percolation of rain or artificially applied water, which means further loss by evaporation or actual flowing away.

The plough, on the other hand, leaves the surface in a condition which allows the rain to percolate more freely and forms a more lasting mulch, as it is not so easily destroyed by light rains; the plough, moreover, is more efficacious for keeping down weed growth. Weeds are not harmful until their roots have extended through the mulch and are drawing on the moisture below, but if one is depending on the cultivator to keep them down they must be dealt with while they are far smaller than if one uses a plough.

Summarised, the arguments for greater use of the plough for summer cultivation are that a more enduring mulch is obtained, weeds do not require such frequent attention, water is enabled to percolate more readily, and loss of surface soil is reduced. It is only fair to state that heavy rains, which will destroy the mulch, may occur soon after the use of the plough, and in such cases the advantage of the more lasting mulch is lost; however, this does not always occur, and the other advantages remain. The cultivator should be looked upon as a quick substitute, and should be used chiefly when it is desired to check immediate evaporation, and the work should be more thoroughly carried out with the plough later as time permits.

One objection to the use of the plough for summer cultivation is that it upsets the levels of the land. This is of greater importance where irrigation is practised. The drawback can be minimised, if not wholly overcome, by using a plough with the mouldboards removed.

It is sometimes argued that it is risky to use a plough among deciduous fruit trees during their active period on account of injury to the roots. Undoubtedly, by the careless use of the plough damage can be done, but though it may not be so discernible, careless use of the cultivator can also cause root injury. Moreover, because the plough maintains a deeper mulch throughout the season, as already mentioned, the trees are prevented from forming roots too close to the surface. The greatest risk of serious root injury occurs when the later winter ploughing is delayed until the trees are active in the spring—feeding roots are disturbed just when there is heavy demand on the tree by blossoming and fruit setting.—A. and P. Notes, N.S.W. Dept. Agric.

Neatsfoot Oil Keeps Harness in Good Order.

For keeping harness in good order, neatsfoot oil needs no recommendation to farmers. The following simple recipe for its manufacture is taken from the "Agricultural Gazette" of New South Wales:—

Neatsfool oil is made by boiling in a suitable receptacle the feet and leg bones (up to the knees) of well-grown cattle. The material should first be thoroughly cleaned by scalding and scraping it free from hair, dirt, &c.; it should then be covered with water, which should be brought to the boil and then allowed to simmer for about two hours. After the oil has risen to the surface it should be skimmed off and the mixture boiled again, and a second skimming made.

The oil thus secured should be strained through a piece of cheese cloth, in order to remove pieces of flesh, &c., from the mixture, and the strained product should then be boiled again, great care being taken that it does not catch fire. Finally, it should be strained again, cooled, and bottled. Pure neatsfoot oil should be light lemon in colour.

The method described is for manufacture on a small scale. Manufacture for trade purposes necessitates the use of a much more detailed and tedious process.

The Home and the Garden.

OUR BABIES.

Under this heading a series of short articles by the Medical and Nursing Staffs of the Queensland Baby Clinics, dealing with the care and general welfare of babies, has been planned in the hope of maintaining their health, increasing their happiness, and decreasing the number of avoidable cases of infant mortality.

THE CHILD WHO "WON'T EAT."

Plain and Wholesome Advice.

IT is not very long since we dealt with this problem under the headings "Tommy Refuses his Dinner" and "Betty's Tangled Troubles." We fear some of our readers took these for fictions. But Betty was a real child, whose case was studied by a learned professor, and Tommy is such a common character that all should know him. The same topic was lately treated in the column headed "Our Babies" in the New Zealand newspapers, some of which we reprint. The advice given is plain and wholesome, and we commend it to those Queensland mothers who are in need of it.

There are just three reasons why a child will not eat.

First: He is sick. No one (adult or child) will eat when he is sick. During illness the digestive capacity is lowered, and refusal of food is Nature's signal that food is not required. The child who is not well should not be forced, coaxed, or cajoled to take food.

The second reason for not taking food is that the child is not hungry for food at that particular meal time. A very few children are naturally small eaters, but in the majority of cases a child who refuses because he is not hungry has had something to eat between meals. There is but one rule for this, and that is to *stop*—absolutely stop eating between meals, including sweets of any kind.

The third reason is the most usual, and has its beginning in the other two. By not eating he gets something which he wants more than food—to be important and the centre of someone's attention. The child soon learns that by refusing to eat he gets much more attention than he does by "being a good boy and eating his porridge." Not only does he enjoy being the centre of attention at meal time, but he enjoys being talked about afterwards. It is a distinction. "I am a peculiar boy. I don't eat any porridge." No healthy child will starve or become under nourished if allowed to do without a few meals or go short for a time, and a little genuine hunger will often work wonders, combined with the salutary lesson that the matter of meals is not so important to the adults as he thought. Once the child realises that he can simply take his food or leave it as far as anybody apparently cares, the chances are that he will take it.

The Parents' Duty.

The parents' duty, then, is to provide suitable food and, having placed the child in contact with that food, to refrain from obvious, anxious effort to induce the child to eat. In other words, the child's relationship to his food is represented by a straight line—child to food; and not by a triangle—child, parent, food.

WOMEN GOLD MINERS.

Women farmers are to be found in every district in Queensland; in fact, from the earliest days of settlement women have had a tremendous influence on agricultural and pastoral development in this country, and "The Women of the West" is a common theme of song and story. Women have now entered the mining field as working miners, according to this extract from Warden Frank G. Illidge's report in the "Queensland Government Mining Journal" for October:—

Although few women actually engage in the search for gold, many are playing a big part in the venture. Joining their husbands and brothers in the rough camp life, sharing their too often hard and meagre fare, their courage is a wonderful tribute to the womanhood of Australia.

On Three Moon Creek, Mrs. W. King is busily engaged in puddling dirt in a wooden trough and cradling and dishing the residue. Her claim is situated a quarter of a mile distant. She has no shaft, but cuts the earth out of the bank and wheels it down in a perambulator to the trough. Her three small children, the youngest boy seventeen months old, all looking a picture of health and tidiness, follow her from place to place, and no doubt lend a hand when required. Thus she combines her maternal duties with the fascinating and profitable work of gold getting. The inevitable specimen bottle was proudly exhibited, and, although not full, contained sufficient to justify the cheery optimism of its owner. Surely, when haloes are being distributed in the hereafter, hers will contain a bright little star for her pluck!

In another locality a less successful attempt was recently made. A stranger to the district brought his wife and two bright young daughters into the district, and pitched his camp near the bank of a creek. A site was selected for a shaft, and while the two daughters attended to the camp duties his wife assumed the responsibility of general manager and braceman while he undertook the role of underground shift boss. All went well until the sink was down 12 feet or so. Leaving the brace for a few minutes while digging was proceeding, the wife returned to the windlass just as the husband, having filled the bucket, pulled the rope down to hook it on. The windless flew round violently, the handle striking the wife in the chest, knocking her flat. When the argument subsided work ceased for the day, and subsequently the general manager resigned, and the shift boss rode into town in search of a job.

WHEAT IN THE HOME.

Emphasing in the course of an address at the State Conference of the Agricultural Bureau of New South Wales the food value of whole wheatmeal, Mrs. M. A. Driver pointed out that the process of producing white flour robs the wheat grain of much of its nutritive virtue. Wheatmeal, it was shown, is almost five times as rich in minerals as white flour—a highly important consideration in the maintenance of health. Farm womenfolk were advised to purchase a small wheat mill—it was not expensive and would last for years—and so ensure that wheat, freshly ground, would be available for use in the home.

The following recipes were given:—

Wholemeal Nut Loaf.

Ingredients.—Two cups wholemeal flour (finely ground), 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, 1½ tablespoons butter, 1 tablespoon sugar, ½ cup nuts, ½ cup raisins, ½ cup sultanas, 1 tablespoon golden syrup, 1 egg, 1 good cup milk.

Method.—Mix flour, sugar, cream of tartar, and soda, and rub in butter; add nuts and fruit. Dissolve golden syrup in milk and add to well-beaten egg. Mix all together, put into greased tins with lids on, and bake about three-quarters of an hour in a moderate oven.

A raisin loaf without nuts can be made if desired.

Wheatmeal Fruit Cake.

Ingredients.—Half pound butter, ½ lb. sugar, 1 lb. fine wheatmeal, 6 eggs, 1 teaspoon cream of tartar, ½ teaspoon carbonate of soda, ½ lb. chopped dates, 2 oz. nuts, ½ lb. raisins, ¼ lb. currants, 1 oz. mixed peel.

Method.—Beat butter and sugar to a cream. Add eggs one at a time and beat for ten minutes. Add fruit, nuts and peel, and wheatmeal, cream of tartar, carbonate of soda, and a little milk if necessary. Put into greased tin and bake from one and a-half to two hours.

Wheat "Coffee."

Ingredients.—Three large cups of wheat, 2 tablespoons treacle, 1 tablespoon golden syrup, 3 teaspoons salt.

Method.—Wash wheat; drain and put into shallow baking dish, sprinkle salt on and mix in treacle and golden syrup, covering well all the wheat. Put into a hot oven and cook for one hour to one and a-half hours, stirring to prevent burning. When well cooked and the colour of the coffee bean when well roasted, remove from oven and allow to cool. Grind through wheat mill and store in sealed tins to keep in the strength.

Use one dessertspoonful of wheat "coffee" powder to each person, and add the hot milk to the coffee when ready to serve.

SUMMER FRUIT DRINKS.

Nothing is more refreshing or pleasing in warm weather than a well-prepared fruit drink, while from a health point of view the habit of drinking fruit juices needs no stressing. Their wholesomeness may be particularly emphasised as beverages for children, who, left to their own devices, are quick to acquire the taste for them. Many so-called orange and lemon drinks contain no fresh fruit at all, but are made from chemicals and artificial colouring matter. Not only do they not have the food value that the real fruit possesses, but they may be definitely injurious to the child's health.

The only drinks of this kind that the child should be permitted to have should be made from the fresh fruit juice. Mothers who make real fruit juice drinks for their children will not be teased for artificial soda and other harmful drinks. Fruit juices not only satisfy thirst; the natural fruit acids they contain supply beneficial elements to the child's diet.

Pineapple Drink.—Wash the skin of pineapple. Place in a lined saucepan with the core and enough cold water to cover. Cook slowly three-quarters of an hour. Add 3 tablespoons or more sugar and the juice of 1 orange or lemon. Strain and allow to cool. Chill and serve.

Fruit Punch.—Take ½ cup lemon juice, 1 cup orange juice, grated rind ½ orange, 1 tablespoon grated lemon rind, 1 quart water, 3 or 4 cups of sugar. Cook water and sugar for 3 minutes, cool and mix with orange and lemon juice, rind, &c. To this add the following ingredients:—(1) 1 quart ginger ale, ¼ cup preserved ginger cut up finely, (2) 1 cup grated pineapple, 1 pint soda water.

Fruit Cup.—Take 2 lemons, 1 quart boiling water, 2 oranges, 4 passion-fruit, 1 ripe pear (if available), 4 tablespoons sugar, few drops cochineal. Wash lemons, peel thinly into a large jug or bowl; squeeze juice and place it in jug with rind and sugar; pour the boiling water over this and cover till cold. Strain into glass jug, colour very pale pink, add slices of oranges, passion-fruit pulp and cut pear or other fruit. Place in ice chest and serve very cold.

TO SUBSCRIBERS—IMPORTANT.

Several subscriptions have been received recently under cover of unsigned letters. Obviously, in the circumstances, it is impossible to send the journal to the subscribers concerned.

It is most important that every subscriber's name and address should be written plainly, preferably in block letters, in order to avoid mistakes in addresses and delay in despatch.

Orchard Notes for December.

THE COASTAL DISTRICTS.

THE planting of pineapples and bananas may be continued, taking care that the ground is properly prepared and suckers carefully selected, as advised previously in these Notes. Keep the plantations well worked and free from weeds of all kinds, especially if the season is dry. New plantations require constant attention, in order to give young plants every chance to get a good start; if checked when young they take a long time to pull up and the fruiting period is considerably retarded. Small areas well worked are more profitable than large areas indifferently looked after, as the fruit they produce is of very much better quality. This is a very important matter in the case of both of these fruits, as with the great increase in the area under crop there is not likely to be a profitable market for inferior fruit. Canners only want first-class pines of a size that will fill a can, and cannot utilise small or inferior fruit, except in very limited quantities, and even then at a very low price. Small, badly filled bananas are always hard to quit, and with a well-supplied market they become unsaleable. Pineapple growers, especially those who have a quantity of the Ripley Queen variety, are warned that the sending of very immature fruit to the Southern markets is most unwise, as there is no surer way of spoiling the market for the main crop. Immature pineapples are not fit for human consumption, and should be condemned by the health authorities of the States to which they are sent.

Citrus orchards require constant attention; the land must be kept well worked and all weed growth destroyed. Spraying or cyaniding for scale insects should be carried out where necessary. Spraying with fungicides should be done where the trees show the need of it. A close lookout must be kept for the first indications of "maori," and as soon as it is discovered the trees should either be dusted with dry sulphur or sprayed with the lime sulphur, potassium, or sodium sulphide washes. Borer should be looked for and destroyed whenever seen.

Early grapes will be ready for cutting. Handle carefully, and get them on to the market in the best possible condition. A bunch with the bloom on and every berry perfect will always look and sell well, even on a full market, when crushed and ill-packed lines are hard to quit.

Peaches, plums, papaws, and lemons will be in season during the month. See that they are properly handled. Look out for fruit fly in all early ripening stone fruit, and see that none is left to lie under the trees to rot and thus breed a big crop of flies to destroy the mango crop when it ripens.

Keep leaf-eating insects of all kinds in check by spraying the plants on which they feed with arsenate of lead.

Look out for Irish blight in potatoes and tomatoes, and mildew on melons and kindred plants. Use Boreaux or Burgundy mixture for the former, and finely ground sulphur or a sulphide spray for the latter.

THE GRANITE BELT, SOUTHERN AND CENTRAL TABLELANDS.

EARLY ripening apples, plums, apricots, peaches, and nectarines will be ready for marketing during the month. They are unsatisfactory lines to handle, as the old saw, "Early ripe, early rotten," applies to all of them; in fact, the season of any particular variety is so short that it must be marketed and consumed as quickly as possible. All early ripening deciduous fruits are poor carriers and bad keepers, as their flesh is soft and watery, deficient in firmness and sugar, and cannot, therefore, be sent to any distant market. The available markets are quickly over-supplied with this class of fruit, and a glut takes place in consequence. Merchants frequently make the serious mistake of trying to hold such fruits, in the hope of the market improving, with the result that, instead of improving, the market frequently becomes more and more congested, and held-over lines have to be sent to the tip. There is only one way to deal with this class of fruit, and that is to clear the markets daily, no matter what the price, and get it distributed and into consumption as rapidly as possible by means of barrowmen and hawkers. Most early ripening fruits are useless

for preserving in any way, their only value being what they will bring for consumption whilst fresh. This being so, it is only a waste of time and money to forward immature, undersized, and inferior fruit to market, as it is not wanted, and there is no sale for it. It should never have been grown, as it is frequently only an expense to the producer, besides which, unless the fallen or over-ripe fruit is regularly and systematically gathered and destroyed in the orchard, it becomes a breeding ground for fruit fly and codlin moth, as well as of fungi, such as those producing the brown and ripe rots. Early ripening fruits should, therefore, be carefully graded for size and quality, handled, and packed with great care, and nothing but choice fruit sent to market. If this is done, a good price will be secured, but if the whole crop—good, bad, and indifferent—is rushed on to the local markets, a serious congestion is bound to take place and large quantities will go to waste.

Orchards and vineyards must be kept in a state of perfect tilth, especially if the weather is dry, so as to retain the moisture necessary for the development of the later ripening fruits. Where citrus fruits are grown, an irrigation should be given during the month if water is available for this purpose, excepting, of course, there is a good fall of rain sufficient to provide an ample supply of moisture.

Codlin moth and fruit fly must receive constant attention and be kept under control, otherwise the later-ripening fruits are likely to suffer severely from the depredations of these serious pests.

Grape vines must be carefully attended to and sprayed where necessary for black spot or downy mildew, or sulphured for oidium. Where brown rot makes its appearance, spraying with the potassium or sodium sulphide washes should be carried out. Leaf-eating insects of all kinds can be kept in check by spraying with arsenate of lead.

Farm Notes for December.

ALTHOUGH November is regarded generally as the best period for planting the main maize crop, on account of the tasseling period harmonising later on with the summer rains, December planting may be carried out in districts where early frosts are not prevalent, provided a known quick maturing variety of maize is sown.

To ensure a supply of late autumn and winter feed, dairymen are advised to make successive sowings of maize and sorghums, to be ultimately used either as green feed or in the form of ensilage. The necessity for such provision cannot be too strongly urged. Farmers who have not had any experience in building an ensilage stack can rest assured that, if they produce a crop for this purpose, information and instruction on the matter will be given on application to the Under Secretary for Agriculture and Stock; also that, whenever possible, the services of an instructor will be made available for carrying out a demonstration in ensilage-making for the benefit of the farmer concerned and his immediate neighbours.

In districts and localities where supplies of lucerne are not available, sowings of cowpeas should be made, particularly by dairymen, as the lack of protein-yielding foods for milch cows is a common cause of diminished milk supplies and of unthriftiness of animals in dairy herds. Cowpeas and lucerne can be depended upon to supply the deficiency. The former crop is hardy and drought-resisting. When plants are to be used as fodder, it is customary to commence to feed them to stock when the pods have formed. Animals are not fond of cowpeas in a fresh, green state; consequently the plants should be cut a day or two before use. Economy is effected by chaffing beforehand, but the plants can also be fed whole. Chaffed in the manner indicated, and fed in conjunction with green maize, or sorghum, when in head, in the proportion of one-third of the former to two-thirds of the latter, a well-balanced ration is obtainable. Animals with access to grass land will consume from 40 to 50 lb. per head per day; a good increase in the milk flow is promoted by this succulent diet. The plant has other excellent attributes as a soil renovator. Pig-raisers will find it invaluable also.

A great variety of quick-growing catch crops, suitable for green fodder and ensilage purposes, may also be sown this month, notably Sudan grass, white panicum, giant panicum (liberty millet), Japanese millet, red and white French millet. Well

prepared land, however, is required for crops of this description, which make their growth within a very limited period of time. French millet is particularly valuable as a birdseed crop, the white variety being more in favour for this purpose.

Successive sowings may be made of pumpkins, melons, and plants of this description.

In districts where onions are grown, these will now be ready for harvesting. If attention is given, in the case of garden plots, to bending over the tops of the onions, maturity of the crop is hastened. Evidence will be shown of the natural ripening-off process, and steps should be taken to lift the bulbs and to place them in windrows until the tops are dry enough to twist off. If a ready market is not available, and it is decided to hold over the onions for a time, special care should be taken in handling. Storage in racks in a cool barn is necessary; otherwise considerable deterioration is to be expected. Improved prices are to be looked for in marketing by grading and classifying produce of this description.

Cotton areas which were subjected to a thorough initial preparation, thereby conserving a sufficiency of moisture for the young plants, should now be making good headway and sending their taproots well down. Keep down all weed growth by scarifying as long as the growth will admit of horse work.

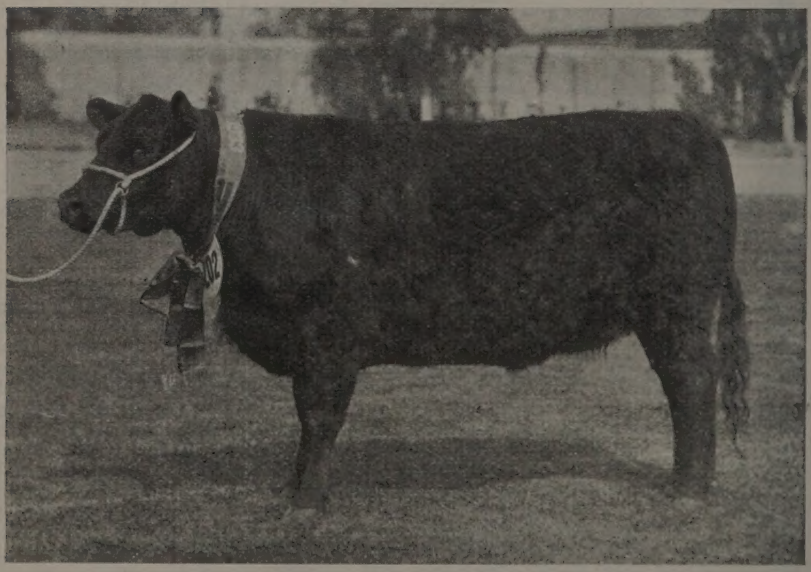

PLATE 124.—BALD BLAIR MERRY.

Winner of the heifer 2 years and under 3 class, Aberdeen-Angus, at this year's Brisbane Show; the property of Messrs. F. J. White and Sons.

CLIMATOLOGICAL TABLE—SEPTEMBER, 1933.

COMPILED FROM TELEGRAPHIC REPORTS.

Districts and Stations.	Atmospheric Pressure. Mean at 9 a.m.	Shade Temperature. Means. Max.	Means. Min.	Extremes. Max.	Date.	Min.	Date.	Rainfall. Total.	Wet Days.
Coastal.	In.	Deg.	Deg.	Deg.		Deg.		Points.	
Cooktown	29·95	83	71	87	30	62	12	38	2
Herberton	..	77	56	83	8	44	12	102	4
Rockhampton	30·08	78	60	87	19	46	10	101	7
Brisbane	30·13	73	56	80	19	46	10	428	9
Darling Downs.									
Dalby	30·10	72	50	87	19	33	10	283	9
Stanthorpe	..	64	44	79	18	20	10	220	11
Toowoomba	..	67	48	82	19	32	10	234	9
Mid-interior.									
Georgetown	29·97	92	60	97	24, 27	48	9	70	2
Longreach	30·02	83	55	95	18	41	9	85	2
Mitchell	30·08	73	49	83	18, 19	33	9, 10	256	4
Western.									
Burketown	29·97	90	64	95	12	58	6, 8, 9 10, 11	Nil	..
Boulia	30·03	82	56	101	18	42	9	1	1
Thargomindah	30·07	73	53	90	18	38	9	103	5

RAINFALL IN THE AGRICULTURAL DISTRICTS.

TABLE SHOWING THE AVERAGE RAINFALL FOR THE MONTH OF SEPTEMBER, IN THE AGRICULTURAL DISTRICTS, TOGETHER WITH TOTAL RAINFALL DURING SEPTEMBER, 1933, AND 1932, FOR COMPARISON.

Divisions and Stations.	Average Rainfall. Sept.	No. of Years' Records.	Total Rainfall. Sept., 1933.	Sept., 1932.
North Coast.	In.		In.	In.
Atherton	0·64	32	1·41	0·10
Cairns	1·64	51	2·55	0·52
Cardwell	1·50	61	4·02	0·07
Cooktown	0·58	57	0·38	0·27
Herberton	0·51	47	1·02	0·12
Ingham	1·46	41	6·17	0·39
Innisfail	3·47	52	4·90	0·56
Mossman Mill	1·38	20	5·24	0·45
Townsville	0·80	62	0·92	0
Central Coast.				
Ayr	1·39	46	2·40	0
Bowen	0·81	62	1·95	0·19
Charters Towers	0·81	51	3·02	0
Mackay	1·57	62	1·54	0·71
Proserpine	2·06	30	5·41	0·90
St. Lawrence	1·29	62	1·83	0·47
South Coast.				
Biggenden	1·52	34	2·97	0·99
Bundaberg	1·61	50	1·21	0·98
Brisbane	2·03	82	4·28	3·00
Caboolture	1·87	46	3·16	3·10
Childers	1·82	38	3·27	2·08
Crohamhurst	2·61	40	8·10	4·02
Esk	2·13	46	2·13	2·27
Gayndah	1·55	62	3·45	1·00
Gympie	2·12	63	4·15	4·00
Kilkivan	1·69	54	3·30	1·65
Maryborough	1·91	61	3·73	2·95
Nambour	2·53	37	4·55	3·00
Nanango	1·81	51	4·51	1·64
Rockhampton	1·35	62	1·01	0·63
Woodford	2·18	46	5·07	2·32

Divisions and Stations.	Average Rainfall. Sept.	No. of Years' Records.	Total Rainfall. Sept., 1933.	Sept., 1932.
Central Highlands.	In.		In.	In.
Clermont	1·04	62	1·92	0
Gindie	1·01	34	5·27	0·10
Springsure	1·26	64	5·18	0·68
Darling Downs.				
Dalby	1·67	63	2·83	1·56
Emu Vale	1·76	37	1·91	3·13
Hermitage	1·53	27	2·01	2·89
Jimbour	1·48	45	1·99	1·20
Miles	1·34	48	1·97	1·09
Stanthorpe	2·28	60	2·20	2·28
Toowoomba	2·14	61	2·34	3·01
Warwick	1·82	68	2·33	3·18
Maranoa.				
Roma	1·41	59	3·52	0·65
State Farms, &c.				
Bungeworgorai	1·35	19	2·94	0·73
Gatton College	1·57	34	1·89	3·11
Kairi	0·63	19	..	0·65
Mackay Sugar Experiment Station	1·45	36	3·01	0·76

GEORGE G. BOND, Divisional Meteorologist.

ASTRONOMICAL DATA FOR QUEENSLAND.

TIMES COMPUTED BY D. EGLINTON, F.R.A.S., AND A. C. EGLINTON.

TIMES OF SUNRISE, SUNSET, AND MOONRISE.

AT WARWICK.

	November, 1933.		December, 1933.		MOONRISE. Nov. 1933.	Dec. 1933.
	Rises.	Sets.	Rises.	Sets.	Rises.	Rises.
					p.m.	p.m.
1	5·3	6·9	4·49	6 33	5·14	5·58
2	5·2	6·10	4·49	6·33	6·12	6·53
3	5·1	6 10	4·49	6·34	7·9	7·45
4	5·0	6·11	4·49	6·35	8·6	8·33
5	5·0	6·12	4·49	6·36	9·0	9·19
6	4·59	6·13	4·49	6 37	9·51	10·0
7	4·58	6·14	4·50	6·37	10·40	10·34
8	4·57	6·15	4·50	6·38	11·24	11·5
9	4·57	6·15	4·50	6·38	a.m.	11·35
10	4·56	6·16	4·50	6·39	12·1	..
						a.m.
11	4·56	6·17	4·50	6·39	12·32	12·5
12	4·55	6·18	4·51	6·40	1·5	12·35
13	4·55	6·19	4·51	6·40	1·36	1·8
14	4·54	6·20	4·51	6·41	2·7	1·45
15	4·54	6·21	4·52	6·41	2·39	2·26
16	4·53	6·21	4·52	6·42	3·15	3·21
17	4·53	6·22	4·52	6·42	3·54	4·23
18	4·53	6·23	4·53	6·43	4·43	5·32
19	4·53	6·24	4·53	6·44	5·42	6·43
20	4·53	6·25	4·53	6·44	6·47	7 54
21	4·52	6·26	4·54	6·45	7·55	9·3
22	4·52	6·27	4·54	6·45	9·4	10·8
23	4·52	6·28	4 55	6·46	10·14	11·8
						p.m.
24	4·52	6·28	4·55	6·47	11·16	12·6
					p.m.	
25	4·51	6·29	4·56	6·47	12·17	1·8
26	4·51	6·30	4·56	6·48	1·15	1·59
27	4·51	6·30	4·57	6·48	2·11	2·57
28	4.51	6 31	4 58	6·49	3·8	3·53
29	4·50	6·31	4·58	6·49	4·5	4·49
30	4·50	6·32	4 59	6·50	5·4	5·42
31			5·0	6·50		6·31

Phases of the Moon, Occultations, &c.

2 Nov.	○ Full Moon	5	59 p.m.
10 „	☽ Last Quarter	10	17 a.m.
18 „	● New Moon	2	23 a.m.
24 „	☾ First Quarter	5	38½ p.m.

Apogee, 7th November, at 9.42 a.m.
Perigee, 19th November, at 11.18 a.m.

Mercury will come to a standstill amongst the stars of Scorpio on the 8th and will be in inferior conjunction with the Sun on the 18th, so that the loop it will make between October 28th, when 24 degrees east of the Sun, and December 6th, when 21 degrees west of it, will become unobservable. On the 28th it will also become stationary amongst the stars of Libra.

Mars will pass 3 degrees southward of Neptune when getting near the western horizon at 11 p.m. on the 12th, but optical aid will be required to see the planet.

When in inferior conjunction with the Sun on the 18th, Mercury will be about 62,870,000 miles from the earth.

An occultation of Regulus will occur on the 11th when it is still at a good height above the western horizon. Observers should note how far Regulus will be eastward of the Moon at 9 o'clock.

When the crescent-shaped Moon rises—about 8 a.m.—on the 21st, Venus will either be behind it or very close to its eastern limb. This will afford a very interesting occasion for observation. Two or three hours later Venus may be looked for on the western side of the Moon.

When the Moon rises—about a quarter past 10 a.m.—on the 23rd, Saturn will be about 2¼ degrees to the west of or above it. It will be occulted when below the horizon in Queensland.

On the 25th Venus will be at its greatest height above the western horizon—rather more than halfway to the meridian—at sunset. Its brightness will increase night after night till January 1st.

On the 28th an interesting sight in binoculars or telescope will be the Moon and Eta Piscium, a small star of magnitude 3·8, which at Cairns will be very near the northern edge of the Moon shortly after 9 p.m., but will become occulted if viewed from places further south in Queensland.

Mercury sets at 8.0 p.m. on the 1st and at 7.4 p.m. on the 15th.

Venus sets at 9.44 p.m. on the 1st and at 9.59 p.m. on the 15th.

Mars sets at 9.6 p.m. on the 1st and at 9.1 p.m. on the 15th.

Jupiter rises at 3.46 a.m. on the 1st and at 2.57 a.m. on the 15th.

2 Dec.	○ Full Moon	11	30 a.m.
10 „	☽ Last Quarter	4	23 p.m.
17 „	● New Moon	12	52 p.m.
24 „	☾ First Quarter	6	8 a.m.

Apogee, 4th December, at 11.18 p.m.
Perigee, 17th December, at 10.6 p.m.

For places west of Warwick and nearly in the same latitude, 28 degrees 12 minutes S. add 4 minutes for each degree of longitude. For example, at Inglewood, add 4 minutes to the times given above for Warwick; at Goondiwindi, add 8 minutes; at St. George, 14 minutes; at Cunnamulla, 25 minutes; at Thargomindah, 33 minutes; and at Oontoo, 43 minutes.

The moonlight nights for each month can best be ascertained by noticing the dates when the moon will be in the first quarter and when full. In the latter case the moon will rise somewhat about the time the sun sets, and the moonlight then extends all through the night; when at the first quarter the moon rises somewhat about six hours before the sun sets, and it is moonlight only till about midnight. After full moon it will be later each evening before it rises, and when in the last quarter it will not generally rise till after midnight.

It must be remembered that the times referred to are only roughly approximate, as the relative positions of the sun and moon vary considerably.

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